

**REPORT OF THE
NATIONAL COMMISSION ON
AGRICULTURE
1976**

**PART IX
FORESTRY**



**GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE AND IRRIGATION
NEW DELHI**

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P R E F A C E

* The Report of the National Commission on Agriculture comprises 69 chapters in 15 parts. A complete list of chapters and parts is given in pages (iii) and (iv). The Terms of Reference of the Commission and its composition are given in Part I — Chapter 1 — Introduction.

This volume, entitled 'Forestry', is Part IX of the Report and is divided into the following six chapters :

41. Forest Policy
42. Production and Social Forestry
43. Minor Forest Produce
44. Forest Ecology and Wildlife Management
45. Forest Protection and Law
46. Forest Planning, Research and Education

Role of forestry in relation to land reclamation and development and soil and moisture conservation has also been dealt with in Part V. Certain other aspects of forestry find mention in relevant portions of different chapters.

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FOREST POLICY

I INTRODUCTION

41.1.1 Forestry has a role in the general economic development of the country through the utilisation of forest products—major and minor. Forests produce the requisite raw materials for industries, defence, communications, other public purposes and domestic use, contribute to the country's export, and create a large volume of employment in the primary, secondary and tertiary sectors. They also provide material for direct use by the agriculturists, like fuelwood, small timber, fodder, grazing, etc. The benefits from forests in the matter of soil and water conservation, recreation, wildlife, etc., have been well recognised.

41.1.2 It may be noted that the Royal Commission on Agriculture (RCA), 1928 limited their enquiries "regarding the forest lands of British India to an examination of the uses at present made of such of them as are under the management of the Forest Department for agricultural purposes in providing fodder for livestock, fuel and timber for the rural population, and protection for soils liable to erosion". Whereas, we have covered the entire range of activities connected with development of forestry as a factor in agricultural progress, as a source of raw material for industrial and other uses and export, as a means of sustaining ecological balance and as provider of employment to large sections of tribal and other population living in or near the forests. As a first step, forest policy needs to be clearly defined.

41.1.3 Forest is recognised as a renewable natural resource. The forestry sector has not been able to make its full contribution to the economic and social growth in the country due to various factors. Although the forest area is a little less than half of the cultivated area, the contribution of the forestry sector to the Net Domestic Product (NDP) is very small and is not commensurate with its potential. The contribution of forestry and logging in 1972-73 was 1.5 per cent at 1960-61 prices¹. As noticed in the advanced countries in the world forestry should be able to do better.

¹ 1975 (January). National Accounts Statistics, 1960-61—1972-73 : Table 4.1. New Delhi. Central Statistical Organisation, Government of India.

41.1.4 Crops and forest both use more or less the same, resources, namely soil and water. But they compete for land. The root cause of the conflict for land has been the increase in population, which the rural economy could not absorb in productive employment. In forestry development and management there were no conscious efforts to generate increasing employment to the unemployed and under-employed in the rural sector. As population increased, more area was brought under arable cropping at the expense of forestry, because the economy was largely, agrarian. Since the importance of tangible and non-tangible benefits over and above timber and fuel was not adequately demonstrated to the rural population, no awareness of the place of forest in the rural economy could develop.

41.1.5 The basic objectives of planned development in India are removal of poverty and attainment of self-reliance. The strategy to attain the objectives will be maximisation of employment in production, particularly in the production of goods and services for mass consumption. Forest management can be fitted in with these planning objectives. Forests by virtue of their proximity to the rural populace can play a key role in creating employment opportunities in the rural economy and at the same time can be managed for meeting the present and future demands for major and minor forest produce.

41.1.6 If the forest programmes are planned on firm lines based upon needs and interests of the people and with the active involvement of the people at the planning and operational levels, the people would accept the programmes irrespective of their illiteracy or other difficulties. The main demands on forestry are two-fold: (a) industrial wood and (b) other forms of produce such as fuelwood, fodder, recreation, etc., which are mainly the minimum social needs in the country. The planned output of forest products, to meet the needs at a price the community can afford, will be forestry's substantial contribution to the removal of poverty, to agricultural progress and to the creation of employment opportunities to large sections of tribal and other population living in these areas.

41.1.7 In the disposal of forest produce, the system invariably involved contractors for logging and sale of standing coupes. It is not unlikely that pilferages from forests occur under this system. Though the neighbouring villagers can sometimes find employment in forestry operations, by no means could the system ensure a regular payment of living wages to the large sections of tribal and other population living in or near the forests. Perhaps other methods can be devised, under which adjoining rural labour can be directly employed to give them a sense of belonging, and by avoiding pilferage ensure a greater revenue to the State and less cost to the consumers.

41.1.8 Many forest based industries produce goods of mass consumption, like paper and paperboard, newsprint, etc., and the target for growth in the national economy cannot be realised unless the forest raw material production for industry keeps pace with the country's requirements. It is estimated that in 1970, while recorded production of industrial wood was hardly 9 million $m^3(r)^*$, the requirement was of the order of 16 million $m^3(r)$. The gap was made up by exploitation of trees from farm lands and, to a great extent, also pilferage from the forests.

41.1.9 Important changes are occurring in the world's forests and timber economy. Since the middle of the century a new dynamism about the forest products consumption is noticeable in every part of the world. It was found that in 1967 wood using industries accounted for more than 5 per cent of the total value of production and about 7.5 per cent of employment in all manufacturing activities in the world. Forests industries were ranked fifth in terms of value and fourth in terms of employment among the world's manufacturing industries¹. As for India, the figures were only about 2.6 and 2.9 per cent respectively, even including such industries which use only a small proportion of wood and wood products.²

41.1.10 In India, concern has been expressed during the last few years about the relatively low density of growing stock of low increment. Demonstrated technology in the world is showing the way for fuller utilisation and also improved productivity from the forests through silvicultural measures. The practice of creating man-made forests, particularly of quick growing species, very often exotic, is a part of it.

41.1.11 Investment in forestry has been inadequate. Even for forest production programmes, financial allocation so far had been very meagre. This has resulted in low production from India's forests. Lack of funds had also prevented programmes of increasing production by clearfelling forests and their replacement by plantation for attaining higher production per unit area. The main cause was that forests had been looked upon as a source of revenue without a realisation of the need for investment. While pleading for a rational pricing of forest produce in future, we stated the following in our Interim Report on Production Forestry—Man-made Forests: "There are a lot of subsidised supply of timber and forest materials to the rural population. From this an attitude has developed that forests material can be given to others without going too much into the economics of

* Cubic metre in the round

¹ King. K.F.S., 1971 (May). Institutional Pre-Condition for Forest Sector Development.

² 1966. Annual Survey of Industries (Census Sector), Vol. I. New Delhi, Central Statistical Organisation (Industrial Statistics Wing), Government of India.

production..... In the name of encouragement to industry, forest material has been leased out for longer period at a very nominal rate of royalty..... The present supply of forest materials to forest based industries is heavily subsidised. If the forests are bled both by the rural sector and industrial sector, there will be no incentive or initiative left to change over from the present low-cost low-yield forestry to a commercial high investment economic forestry development."

41.1.12 There is a lack of linkage between forestry and forest industries in India, often resulting in inadequately formulated programmes and plans for both these sectors. The requirements of industry should be a major reason for initiating forestry activities. As such, the essentiality of planning for forest resource before planning any forest based industry should be emphasised. This was not done in the past. It takes a long period for forest produce to mature for industrial utilisation. So the planning for forest resources must take into account this inevitable time lag, which may be anything from 10 to 30 years or more. Pricing of forest produce for industry should be fixed on remunerative basis, so that adequate funds are available for the essential cost of regeneration, maintenance, etc.

41.1.13 One important determinant of the economic growth rate in the developing countries is the capacity to import and to improve balance of payments position. With the planned development there will be an increasing demand for goods for mass consumption, the most important in the forestry sector being paper, paperboard and newsprint. Substantial foreign exchange is expended on the import of these commodities. The goal of attaining self-sufficiency in these sectors will not be reached, unless a dynamic approach is adopted towards management*of forest resources.

41.1.14 The forestry cadres in India belong mainly to the biological stream of forestry. These cadres are required to be supplemented on the economic and utilisation side and also on the ecological and land-use side. A lacuna has developed both in the practice and research in forestry. The forest research base is currently very inadequate leading to the accumulation of a large number of basic and applied problems of conservation and development of existing resources. Lack of any organised statistical base is reflected in the poor planning in the States as well as in the Centre.

41.1.15 We took note of several detailed studies on different aspects of forest management and development by various bodies since the RCA's Report. We have already analysed the current situation and presented our views on aspects basic to forest progress, for bringing in a new dynamism to Indian forestry, in the following Interim Reports:

- (i) Production Forestry—Man-made Forests (August, 1972);

(ii) Social Forestry (August, 1973);

(iii) Forest Research and Education (March, 1974).

Besides, forest development constituted a part of the Interim Report on Desert Development. We are convinced that a new approach to forest development has to be built up.

2 FORESTRY BEFORE INDEPENDENCE

41.2.1 The history of forest development is difficult to compile, because the history of Indian forestry would have to refer to the forests of the sub-continent of India and Burma. Moreover, recorded information is available in some detail for the forests which were directly under British administration. But information with regard to forests situated in the erstwhile princely states and those held by *zamindars* and *jagirdars* is generally incomplete. No continuous history is available for the entire forest tracts in many of the States as they exist today, since there have been changes due to (a) formation of new provinces, like Bihar, Assam and Orissa prior to Independence, (b) the merger of the princely states after Independence, (c) the formation of Andhra State in 1953, (d) large scale acquisition of private forests belonging to different rulers of the states and private owners in the fifties, (e) the general reorganisation of the States in 1956, and (f) the changes since 1960 creating many new States by reorganisation. A review of the last fifty years would furnish the background of the modern Indian forestry. In 1921, the administration of the forests came to vest in the Government of the provinces concerned. With the grant of provincial autonomy under the Government of India Act, 1935, forests came to be completely vested in the provinces. The Government of India and the Inspector General of Forests were to concern themselves only with the common and general aspects of forestry, i.e. forest research and education, soil conservation, etc., and they ceased to have direct authority and control over the administration of the forests in the provinces, where the Chief Conservators of Forests became responsible only to their respective provincial administrations.

41.2.2 During the twenties and the thirties, there were several areas in forest management where progress was significant. The coverage by regular working plans increased. Major silvicultural problems, like natural regeneration of *deodar* [*Cedrus deodara* (D. Don) G. Don f.] in the Western Himalayas and artificial regeneration of teak (*Tectona grandis* Linn. f.) in South India, were successfully tackled and standard procedure evolved. Natural regeneration of *sal* (*Shorea robusta* Gaertn. f.) continued to receive energetic attention, while

artificial regeneration by *taungya* method became the widespread practice in Eastern and Northern India. It should, however, be pointed out that the management practice, preparation of working plan, silviculture, etc., were prescribed with an orientation towards conservation. Inadequate allocation of funds discouraged any aggressive programmes of management and research. In the matter of soil conservation, the Punjab Forest Department took the lead in initiating action and focussing attention on the urgency of this problem. Noticeable was the matter of reclamation of *chols*, small seasonal streams at the base of hills, which were eroding large areas.

41.2.3 The Second World War affected forestry practices all over the country. The demands made on India's forests were of much greater magnitude than those during the World War I. Enormous quantities of timber, from almost every wood species, were extracted causing extensive fellings and advance working in almost all forests divisions in the provinces. There were also extensive over-fellings in private forests and forests in the princely states. Many varieties of timber which were not used previously in any appreciable quantity began to be consumed in large quantities. The plywood industry came into its own during this period and many new plywood factories were started, especially in the Calcutta area.

41.2.4 Towards the end of the Second World War, the then Inspector General of Forests made out a note on the priorities in post-war forestry works for India, mainly for the purpose of rehabilitation of the overworked forests and improving future forest working. As a result, a number of post-war development schemes were initiated in late forties involving large scale plantation activities and the expansion and improvement of the means of communications. The Forest Research Institute (FRI), Dehra Dun was expanded and reorganised to meet the increasing needs of forest research, forest production and utilisation. The research done earlier in the FRI paved the way for large scale utilisation of bamboos as the principal raw material for paper and pulp production, and a number of large scale pulp and paper mills came to be set up. Research in the Institute indicated the suitability of several hardwoods for making writing and printing paper. A large number of plywood industries, based on species tested in the FRI, came to be set up in different parts of the country during the war years and after*.

41.2.5 Some aspects of the forest management during the second quarter of the century prior to Independence could be best appreciated by study of a few indicators. One of them is the revenue and expendi-

* For a complete record of the development of Indian forestry. 'One Hundred Years of Indian Forestry—Vols. I & II', 1961 may be seen.

ture from the forests under Government ownership. Table 41.1 gives the progress from 1936-37 to 1947-48.

TABLE 41.1

Average Annual Revenue and Expenditure of Forest Departments in India
(including FRI & Colleges)¹

(thousands of rupees)

Average for the period	Gross Revenue	Expenditure	Surplus	Surplus as percentage of gross revenue
1936-37 to 1938-39 . . .	2,58,68	1,94,37	64,31	24.9
1939-40 to 1941-42 . . .	3,27,46	2,09,00	1,18,46	36.2
1942-43 to 1944-45 . . .	8,30,18	4,92,00	3,38,18	40.7
1945-46 to 1947-48 . . .	14,92,81	6,76,81	7,86,00	53.7

41.2.6 A review of the trend of revenue, expenditure and net surplus indicates a rapid rise under the three heads. The average for the 1936-37 to 1938-39 represents the condition prior to the Second World War. The war gave a remarkable impetus to the extraction and utilisation of forest produce. The gross revenue, expenditure and surplus which were Rs. 2.6, 1.9 and 0.6 crores respectively prior to the World War rose to Rs. 14.6, 6.8 and 7.9 crores in the period 1945-46 to 1947-48 just after the War. Part of it may be due to the rising level of prices of all commodities, but bulk of the rise may be attributed to more supplies made for the war efforts.

41.2.7 Another indicator of forest activities is the extent of area brought under concentrated regeneration. For one of the provinces, Bengal, the progress in area under natural and artificial regeneration was as follows:

Year	Area (in ha) under ²	
	Natural regeneration, including coppice	Artificial regeneration
1929-30	1,311	671
1935-36	846	851
1940-41	861	923
1945-46	1,557	1,114

It is seen that intensification of forest exploitation continued to rise at a steady rate. Again, the fact that area covered by natural regeneration during the thirties continued to be at a low level, probably

¹1961. One Hundred Years of Indian Forestry, 1861-1961, Vol II : p 287 (Table XXII-A), Dehra Dun, Forest Research Institute.

² Silviculturist (North), West Bengal Forest Department.

shows the preference for the more concentrated form of forest exploitation during the time of low prices and demand in the depression years.

3 ROLE OF FORESTRY IN ECONOMIC DEVELOPMENT

41.3.1 Contribution of the forestry and logging sector to the net domestic product at factor cost (at 1960-61 prices) was only 1.3 per cent in 1960-61 and as already stated 1.5 per cent in 1972-73. It is not expected to rise much in the near future. Several reasons may be identified for this state of affairs, much of which may be traced to the conservation oriented forestry practised at present. The present system has evolved largely due to a limited market demand and inadequate funds for creating man-made forestry. Clearfelling entailed the harvesting and marketing of a large quantity of several species, many of which had very little use except as fuelwood. As fuelwood was only saleable in the urban areas much away from forests, any large felling especially in the interior forest areas could not have paid for even the felling cost. Due to a limited demand for secondary hardwood species and with a view to encouraging establishment of plywood industry, royalty rates were kept low. The revenue fetched could not suffice for essential requirements of regeneration and maintenance. About 94 per cent of India's forests are hardwood forests and the use of miscellaneous hardwood in the pulp market was only developed recently. Against this background, even in good areas of growth within reasonable reach of the market, the Forest Departments followed the practice of selection and improvement felling. Areas with poor communication and distant from the market were left unexploited, because the cost of harvesting and bringing the timber to the market would have been prohibitive. This has resulted in less production, less income, less requirement of ancillary services and less employment.

41.3.2 The prescribed yield from the coniferous forests in the States of Himachal Pradesh, Jammu & Kashmir and Uttar Pradesh is about 2.17 million m³ from an area of 1.70 million hectares, i.e. about 1.27 m³/ha, quite a low rate of production for softwood forests. But the actual outturn in 1969-70 was only about 1.15 million m³, i.e. about 0.67 m³/ha. In the hardwood forests in Maharashtra, the present net worth of the valuable teak forests (containing 20 per cent or so of teak) is only Rs. 57 to Rs. 113 per hectare on a rotation of 80 years. As against this, the present net worth of a stand of pure teak under identical conditions would be about Rs. 1,580 per hectare. In West Bengal, the natural forests yielding a revenue of about

Rs. 1,470 per hectare, when planted with teak, have yielded a revenue of Rs. 26,000 per hectare in 40 years from thinnings alone.

41.3.3 Each hectare of forest land should be in a position to yield a net income many times more than is being obtained at present. As mentioned in our Interim Report on Production Forestry—Man-made Forests, a gross revenue of Rs. 21.50 and a net return of Rs. 11.50 per hectare are being obtained from the country's forests, with an average plan and non-plan expenditure of Rs. 10 per hectare. If progressive methods are adopted, a much higher net return may be expected, as in other countries. For instance, it was calculated¹ that in West Germany an expenditure of Rs. 435 per hectare brings in a gross income of Rs. 565 and a net return of Rs. 130 per hectare. It may be argued that the expenditure ratio in India is much better than that obtained in the more advanced countries. But the social cost in the matter of under and un-utilised resources, foreign exchange drain for import of newsprint and paper, and reduced employment is very high. Forestry can get out of the rut of low productivity and perpetual shortages of essential forest-based industrial products by going in for balanced inputs at higher cost as against traditional forestry with low cost inputs. In this connection, the position regarding man-made forests may be quoted. Prior to the First Plan (upto 1950), the area brought under man-made forests was only 29,210 ha. From 1951 to 1972, the area planted was about 1.79 Mha, but even then by the end of the Fourth Plan, only about 2-3 per cent of the total forest area has been brought under man-made forests. Since man-made forests can contribute to much higher productivity, it is necessary to intensify efforts in this direction.

41.3.4 Forest based industries occupy comparatively a minor position in the manufacturing activities in India. The position with regard to the organised industries is given in Table 41.2.

TABLE 41.2

Productive Capital, Employment and Value Added in Primary and Secondary Forest-based Industries (Census Sector)²

Items	Unit	1965		1969	
		Total	percentage of all industries	Total	percentage of all industries
productive capital . . .	Rs. in crores	159.25	2.47	211.41	2.09
number of workers employed	number in thousands	112,669	282	116,814	2.80
value added by manufacture	Rs. in crores	44.89	2.64	72.41	2.93

¹ 1967. Cost Studies in European Forestry, No. 49, Stockholm, Sweden, Royal College of Forestry.

² Annual Survey of Industries (ASD-Census Sector, 1965 and 1969 (draft). Central Statistical Organisation (Industrial Statistics Wing), Government of India.

The above table covers only the census sector* of the ASI. Most of the saw mills in India are small and as such do not come within the purview of the census sector of the ASI. Nevertheless, it is apparent that intensive industrial utilisation is lacking. Against the background of acute shortages in such forest based products as pulp and paper, and possibility of higher exports of such products as plywood and veneer, it is expected that the forest based industries may assume greater importance in India's economy, with the introduction of a dynamic programme of production forestry recommended by us in our Interim Report on Production Forestry—Man-made Forests.

41.3.5 Employment of forestry personnel in the State Forest Departments was estimated to be about 50,000 in 1961¹. The National Progress Report on Forestry, India, 1969-73² prepared for the Ninth Session of the Asia Pacific Forestry Commission shows the following number of forestry personnel employed by the State Forest Departments at the end of 1972 :

	Staff in position (number of persons)
forest education	276
forest research	1,539
state forest organisations	91,705
other public forests	nil
total	93,520

It is to be noticed that the number doubled over a period of about 10 years. Separate figures according to professional, technical and vocational grades are not available.

41.3.6 Forest personnel of the State Forest Departments, however, constitute only a small fraction of the employment in forest operations. The forests provide considerable employment, mostly seasonal, in jobs like forest plantations, silvicultural operations, building and road construction, harvesting and transport of forest produce. It was estimated³ that in the year 1950-51 approximately 4 lakhs* of people depended on forestry for their livelihood, constituting 0.2 per cent of the economically active population. A quick estimate based on one per cent sampling of the enumeration slips of the 1971 census shows that only about 2.5 lakhs persons were employed in forestry, 80 per cent of whom were rural. Percentage of workers in forestry

* Factories employing 50 or more workers with the aid of power or 100 or more workers without the aid of power.

¹ 1961. One Hundred Years of Indian Forestry, 1861-1961, Vol II : Table XVIII. Dehra Dun, Forest Research Institute.

² 1973. Ministry of Agriculture & Irrigation, Government of India.

³ 1961 (May). India, 1961—A Reference Annual : Table 74. New Delhi, Ministry of Information & Broadcasting, Government of India.

constituted 0.14 per cent of the total working population of 179.34 million. In the rural areas the percentage would be 0.15. However, the 1950-51 and 1971 figures are not comparable. The reference point of time is April, 1971 and it is well known that March and April are the slackest months for forestry operations. Moreover, the figures relate only to wholetime employment in forestry. We have explained in the next chapter that employment in forestry should be considered as alleviating seasonal unemployment and/or underemployment and contributing to an increase in the income level of rural households rather than be projected as full time employment for a certain number of persons. It was estimated¹ by the Central Forestry Commission that forestry activities provided employment of about 900 million man-days, of which 80 per cent, i.e. 720 million man-days, was in primary forestry activities mentioned above. The contribution of forestry to employment, therefore, would be considerably more than is apparent from the wholetime employment data shown by the sample survey of census enumeration slips.

41.3.7 India had always imported forest-based products,* mostly newsprint, paper, paperboard and pulp. Forest products have also figured significantly in the export trade of the country. In 1973-74 the total foreign exchange earnings from the export of forest products amounted to Rs. 95.42 crores when their import totalled Rs. 46.97 crores. Imports of newsprint, paper, paperboard and pulp alone amounted to over Rs. 29 crores in 1973-74. With the international price of newsprint going up and no immediate prospect of self-sufficiency of newsprint, paper, etc. their imports in value terms, are likely to be higher. While export of all commodities went up by 284.4 per cent in terms of value between 1961-62 to 1973-74, the export of forest products rose even higher and almost quadrupled itself during that period. On the other hand, though overall imports went up by 174.8 per cent during that period, the import of forest products rose only by 61.9 per cent.

41.3.8 Despite rapid advancement made during the last 25 years in various fields including agriculture, the agriculturists' direct consumption of forest products remains more or less the same as was recorded by the Royal Commission on Agriculture. Most of the cultivators still live in a house made of wood and thatch, use the age-old country ploughs, use cattle for tilling and drawing the cart made largely of wood and bamboos. For all these domestic needs, small timber, fuel, grass, fodder and other forest products are of paramount importance. For the people living in the vicinity of the forests, there are many products apart from fuel and fodder which

¹ Note on Employment Potential in Forestry Sector, Mimeographed, date not specified.

are directly consumed, like bamboos, agricultural implements, fibres and flosses, fruits, *mahua* (*Madhuca longifolia* (Koenig) MacBride) flower, *tendu* (*Diospyros melanoxylon* Rox.) leaves for *bidi* manufacture, barks and leaves for tans and dyes, gums and resins, etc. and others too numerous to be mentioned here. The consumption goods are obtained free or at nominal rates, because of the incidence of rights, and privileges (called *nistar* in some parts of the country). An accurate estimate of the contribution by the forestry sector to the agriculturists' consumption is not available. In one area alone, i.e. in the recorded production of industrial wood, it was estimated¹ that in the late sixties the free grantees, right and leaseholders got about 5.5 per cent of the total production. Figures received from some of the Chief Conservators of Forests show that the imputed market value of forest products consumed by free grantees and rights-holders in Rajasthan amounting to Rs. 34.54 lakhs constituted about 26.8 per cent of the total forest revenue of Rs. 128.70 lakhs realised for the year 1971-72. In Uttar Pradesh, figures are available for 1970-71. The imputed value of forest products consumed by free grantees and right-holders was Rs. 115.50 lakhs against a total forest revenue of Rs. 2,147.86 lakhs, i.e. 5.4 per cent. The figure for Gujarat for 1972-73 was 3.4 per cent.

41.3.9 We shall deal later in greater details the steps needed to secure optimal role of the forests in meeting the agriculturists' needs of small timber, fuel, grazing and fodder and other minor forest products, and to provide employment to tribals and rural unemployed and underemployed in the work of harvesting and marketing of major and minor forest produce. Mention should be made here of the shift in the national forest policy between 1894 to 1952. Under 1894 policy, it was laid down that, subject to certain conditions, the claims of cultivation are stronger than the claims of forest preservation. In view of the rising demand for processed wood products in the home market and foreign countries and the escalating cost of import of vital wood-based products, the intrinsic right of forests on lands was fully recognised in the 1952 policy.

4 FOREST DEVELOPMENT UNDER THE FIVE YEAR PLANS

41.4.1 At the time of Independence, India inherited a regular organisation for forestry activities. India's forests were being worked according to working plans drawn in advance and revised periodically.

¹ 1972 (Feb). Removal of Wood and Bamboo, Bulletin No. 13 : Table 1.3. New Delhi, Central Forestry Commission, Ministry of Agriculture & Irrigation, Government of India.

Though the management aimed at improving the composition and growing stock of the forests through silvicultural practices or by artificial regeneration, more importance was placed on conserving forest capital and on attaining 'normal' forests. Forests were worked on a sustained yield basis and expenditure for works of improvement, such as cultural operations, construction of roads, etc., was mainly guided by the revenue earning potential of the forests in a particular region, and not always towards making an overall development of country's forests with a wider objective.

41.4.2 The forest areas of the former princely states were brought under direct management of the Government on the integration of these states with the Indian Union. The Estates Acquisition Acts also came to be promulgated in most of the States in the early fifties, and under their provisions large tracts of private forests held by *ex-zamindars* also vested in the Government. The degraded or denuded nature of most of these forest areas further demanded that they should receive special attention.

The First and Second Plans (1951-61)

41.4.3 During this decade, the focus was on the rehabilitation of the degraded forests and the creation of plantations of economically important species suitable for matchwoods and other uses. During the Second Plan, the stress was also on the conservation of wildlife and several wildlife sanctuaries were established.

The Third Plan (1961-66)

41.4.4 The Third Five Year Plan laid special emphasis on measures to meet the long term requirements of the country and to ensure more economic and efficient utilisation of the valuable forest products. The immediate objective was to increase the output from the existing forests through better techniques of timber extraction, improvement of communications and popularising the use of less commonly known secondary Indian timber after proper seasoning and preservative treatment. As the various schemes implemented during the Third Five Year Plan period were oriented towards attaining "self-sufficiency in industrial timbers, fuelwood and other forest products" large scale plantations of industrially valuable species were undertaken. In order to encourage State Governments to undertake plantations of quick growing species, particularly to meet the requirements of pulp and paper, a new Centrally sponsored scheme "Plantation of Quick Growing Species" was introduced.

41.4.5 With a view to investigating the availability of raw materials in the possible industrial catchment areas and determining their economic viability, a project, called 'pre-investment Survey of Forest Resources', was initiated during the plan period in collaboration with the United Nations Special Fund (UNSF) and Food and Agriculture Organisation (FAO) of the United Nations. It was accepted as a matter of policy that in order to obtain higher timber yields from the forest areas under exploitation and to reduce wastage, improved logging tools have to be used. Training of forest officers and field executives in the State Governments and of lessees and forest contractors in logging planning and efficiency studies was started with the establishment of logging training centres set up with the assistance of the UNSF.

The Annual Plans (1966-69)

41.4.6 During the three annual plan years (1966-69), specific emphasis was laid on plantations of quick growing species and modernising harvesting and plantation techniques.

The Fourth Plan (1969-74)

41.4.7 In the sector of forestry, three main objectives were aimed at during the Fourth Plan. These were: (a) to increase the productivity of forests, (b) to link up forest development with various forest based industries, and (c) to develop forests as a support to rural economy. Emphasis was laid on measures to meet the immediate and long term agricultural and industrial requirements. Further efforts were made at creating large scale plantations of valuable quick growing species and species of economic and industrial importance. Concerted efforts at regenerating areas, where forest produce was removed for industrial uses, were taken. The object was to achieve self-sufficiency in forest products as early as possible, specially for major forest based industries such as pulp, paper, newsprint, wood panel products and matches so that the imports of some of these items may be replaced and some sizeable exports of pulp and wood panel products built up.

Financial Achievements under Development Plans

41.4.8 Scheme-wise details of expenditure incurred on forest development in the country during the different plan periods is given in the

Appendix 41.1: An analysis of these figures shows that of the total expenditure of Rs. 117.70 crores incurred during 1951-69, 23 per cent has been spent on economic plantations for industrial and commercial uses. The same percentage of expenditure was maintained in the Fourth Plan period. The plantations of quick growing species accounted for about 11.4 per cent of the total expenditure during the period 1951-69. The low percentage was due to the fact that this scheme was started only in the Third Plan period with a modest beginning. In the Fourth Plan period, the total expenditure on this scheme was about 18.9 per cent. The scheme on farm forestry-cum-fuelwood plantations accounted for 2.2 per cent of the total expenditure for the period 1951-69, mainly because of its late start in the Third Plan period. In the Fourth Plan period, the proportion was about 4.1 per cent, more or less the same as was reached in the annual plan period.

The Fifth Plan (1974-79)

41.4.9 The primary objective in the Fifth Plan is to take up a dynamic programme of production forestry, aiming at clearfelling and creating large scale man-made forests with the help of institutional financing. The produce from clearfelled areas is also to be utilised in wood based industries by locating additional units wherever required. The second important objective is to develop farm forestry and to improve degraded forests so as to increase the fuel and timber supply in the rural areas. A system of meaningful forest surveys to assess the present growing stocks, increments and potential increments by forest divisions, natural regions and States, along with a proper information system will also be built up.

41.4.10 A network of State forest corporations is proposed to be created for the establishment and management of man-made forests and forest based industries, in accordance with the recommendations in our Interim Report on Production Forestry—Man-made Forests. Project Planning approach is to be widely used, and special efforts are proposed to be made in the Fifth Plan to prepare a number of projects in various States, indicating the immediate and long-term benefits in terms of increased raw materials for industries and additional revenues at different levels of investment.

41.4.11 The financial position of the working of the Forest Departments in India can be judged from the Table 41.3 reproduced below:

TABLE 41.3

Average annual Revenue, Expenditure and Surplus of Forest Departments in India

(crores of rupees)

Average for the period	Gross revenue	Expenditure—plan & non-plan	Surplus	Surplus as percentage of gross revenue
1951-52 to 1953-54 . . .	24.01	10.62	13.39	55.7
1956-57 to 1958-59 . . .	41.84	17.12	24.72	59.1
1961-62 to 1963-64 . . .	69.38	32.23	37.15	53.6
1966-67 to 1968-69 . . .	107.50	56.63	50.87	47.3
1969-70 to 1971-72 . . .	135.87	73.49	62.38	45.9

The triennia coincide with the first three years of each plan period. When compared with Table 41.1 given in Paragraph 41.2.5, it is found that the percentage of gross revenue diverted to expenditure did not change much till the late sixties from the position just before Independence. The trend in the outturn of the major forest produce for the past 20 years or so may be seen from the following recorded production of wood in India :

TABLE 41.4

Production of Wood in India

(million m³(r))

Year	Industrial wood	Fuelwood
1956-57	4.46	10.18
1961-62	5.43	10.75
1966-67	9.28	12.24
1969-70	8.93	12.86
1970-71	9.12	13.70

It appears from the above figures that almost a plateau has been reached since 1966-67.

5 NATIONAL FOREST POLICY

National Forest Policy of 1894

41.5.1 Development of forests is expected to follow the policies adopted for management of forests in the country. Before Indepen-

dence, India already had a national forest policy enunciated in 1894, which ran as under:

- (i) the sole object with which State forests are administered is public benefit. In general, the constitution and preservation of a forest involve the regulation of rights and the restriction of the privileges of the user in the forest by the neighbouring population;
- (ii) forests situated on hill slopes should be maintained as protection forests to preserve the climatic and physical conditions of the country and to protect the cultivated plains that lie below them from the devastating action of hill torrents;
- (iii) forests which are the reservoirs of valuable timbers should be managed on commercial lines as a source of revenue to the States;
- (iv) wherever an effective demand for culturable land exists and can only be supplied from forest area, the land should ordinarily be relinquished without hesitation, subject to the following conditions:
 - (a) honeycombing of a valuable forest by patches of cultivation should not be allowed;
 - (b) cultivation must be permanent and must not be allowed to an extent as to encroach upon minimum area of forest that is needed to meet the reasonable forest requirements, present and prospective; and
- (v) forests that yield only inferior timber, fuelwood or fodder, or are used for grazing, should be managed mainly in the interest of the local population, care being taken to see that the user is not exercised so as to annihilate its subject and the people are protected against their own improvidence.

This policy was based on the desire that forests serve agricultural interests more directly than before.

National Forest Policy of 1952

41.5.2 After Independence, it was considered necessary to revise the forest policy. It was felt that "the revolutionary changes which have taken place during the interval in the physical, economic and political fields called for a reorientation of the old policy." It was stated that the value of forests was recognised not only in the physical field, such as conservation of moisture and prevention of erosion, but also in the economic field, such as development of agriculture, industry and communications. The post-war reconstruction schemes also involved industrial expansion, river valley projects and development of

communications, all of which leaned heavily on the produce of forests.

41.5.3 The National Forest Policy was revised in 1952 and was issued as a Resolution of the Government of India. It proposed the classification of forests on a functional basis into protection forests, national forests, village forests and treelands. It emphasised the need for evolving a system of balanced and complementary land-use, under which each type of land was to be allotted to that form of use under which it would produce most and deteriorate least. The Policy considered it desirable to establish treelands wherever possible for the amelioration of physical and climatic conditions, and for promoting the general well-being of the people. It also made provision for ensuring progressively increasing supplies of grazing, timber for agricultural implements and firewood to release cattle-dung for use as manure. The national Policy also discouraged indiscriminate extension of arable land by the excision of forests, as this not only deprives the local population of wood, grass, etc. but also deprives the land of its natural defence against dust storms, hot wind and erosion. It emphasised that the notion widely entertained that forestry as such has no intrinsic right to land, but may be permitted on sufferance on residual land not required for any other purpose, has to be combated. The role of forests, productive, protective and bio-aesthetic, entitles them to an adequate share of land to promote public well-being and ensure the balanced economy. The Policy also laid down that it would be the duty of the forester to awaken the interest of the people in the development, extension and establishment of treelands wherever possible, and to make them treeminded. The national forests were to be managed on the principle of progressively increasing sustained yield to meet the requirements of defence, communications and industry. It also emphasised the need for affording protection to wildlife by its proper management for scientific study and for recreational purposes. The Policy laid stress on (a) weaning the tribal people, by persuasion, away from the baneful practice of shifting cultivation, (b) increasing the efficiency of forest administration by having adequate forest laws; (c) giving requisite training to the staff of all ranks; (d) providing adequate facilities for the management of forests and for conducting research in forestry and forest products utilisation; (e) controlling grazing in the forest; and (f) the need for promoting the welfare of the people.

41.5.4 As administration of forests vests entirely with the States, they are the ultimate authority to implement a policy decision. The provisions in the Policy have not been fully implemented by them for various reasons. As mentioned earlier, functional classification pro-

vided for in the policy statement could not be implemented. No systematic programme was drawn up to extend existing treelands and establish new ones on lands belonging to Defence, Railways, Public Works Departments, universities and colleges and other local authorities, etc. Relinquishment of forest land continued to occur for various purposes, and the notion that forestry might be permitted on sufferance on residual land not required for any other purpose continued to hold sway. No concerted efforts were made to bring the recommended 60 per cent of area under forests in the mountainous tracts liable to erosion and 20 per cent in the plains. Hardly any of the principles on forest grazing was implemented. The implementation would have been more effective, if the Policy had been adopted by the State Legislatures.

Central Board of Forestry

41.5.5 Even before the revised National Forest Policy was introduced, the Government of India had constituted a Central Board of Forestry (CBF) in 1950 to provide guidance to the Government in the formulation of policy and programmes in the field of forestry. The CBF set up its own standing committee to follow up the implementation of its recommendations. The composition and functions of the CBF and its standing committee are reproduced in Appendix 41.2.

41.5.6 The CBF is the successor to the Board of Control which was set up in the late nineteenth century under the chairmanship of the Inspector General of Forests for ensuring adequate standards in the forestry training imparted at the Forest School at Dehra Dun. In those days membership of the Board was confined to three Conservators of Forests invited by the Chairman by rotation. In 1906, when the Forest Research Institute (FRI), Dehra Dun came into being, the scope and the functions of the Board of Control were enlarged and representation on it was extended to include all erstwhile British provinces. After the introduction of Montague-Chelmsford Reforms in 1921, doubts were expressed regarding the advisability of continuing the Board. Opinion elicited from the various provinces in the matter, however, revealed that such an all-India body served a useful purpose in that it acted as a forum for the exchange of experience, as a clearing house of information and as a coordinating agency for forest research, education and standardisation of forestry practices. After Independence, the need for setting up a Central forest organisation to suit the altered conditions was voiced at the Conference of the State Ministers in charge of forests on September 8 and 9, 1948. It was in pursuance of the recommendations of that Conference that the CBF

was constituted in June, 1950 at the Ministers' level in the belief that its deliberations would evoke universal response, inspire public confidence and win country-wide support.

41.5.7 The CBF became the supreme advisory body for review of national forest policy, formulation of detailed policy and for its implementation. The CBF had in all twelve meetings between May 1951 and May 1970, the thirteenth and fourteenth meetings having been held as late as February 1973 and October 1974 respectively. Some of the more important recommendations of the CBF on forest policy and its implementations are given in Appendix 41.3.

National Forest Policy—A Case for further Revision

41.5.8 Since the enunciation of this policy in 1952, developments of far reaching importance have taken place in the economic, social and political fields. Increase in population has given rise to diversified demands for a great variety of forest products on the one hand, and has built up heavy pressure on land on the other hand, resulting in substantial loss of forest land. In the silvicultural and management techniques and in technological and industrial fields considerable progress has been registered opening avenues for further expansion and integration of forest based industries. The economic and social benefits accruing to the community from forests and forest based industries have come to be better understood as also the role played by forests in conserving soil in the catchments of rivers and river valley projects. The basic objectives of the development plans have been: removal of poverty by generating economic growth and employment, balanced regional development and self-sufficiency in the matter of products of daily use. As self reliance is the fundamental objective of future economic and industrial development, there is need for the concept of multiple use of forest lands, greater attention to increase the productivity of forests and their scientific management on modern lines. Thus while the fundamental concepts underlying the existing forest policy still hold good, we feel that in the light of changes which have taken place since its enunciation, the forest policy has to be reoriented.

41.5.9 In any revision of the National Forest Policy, note has to be taken of the significant stresses on, and shifts in, the forest policy that have come out of the recommendations of the CBF. Some of the more important recommendations of the CBF on forest policy have been given in Appendix 41.3. The Estimates Committee (1968-69) of the Fourth Lok Sabha, in its Seventy-Sixth Report, also opined that a reappraisal of the National Forest Policy should be made by an *ad hoc* body of experts in the light of experience gained during the

years of development plans and the research and technological advancement made in the international field of forestry, and that they should also suggest other suitable changes in the existing policy so as to make the new revised policy a more purposeful, realistic and effective apparatus for the development of forests and forestry in the country.

41.5.10. The important observations of the Estimates Committee in this respect were:

- (i) effective steps should be taken by the Central Board of Forestry to increase the forest area in the various states;
- (ii) proportions of the area that ought to be under forests in each State/Union Territory should be clearly indicated;
- (iii) the Central Government should accord priority to the detailed survey of all lands as a basis for evolving a system of balanced and complementary land-use;
- (iv) necessary steps should be taken to demarcate forests on functional basis and to collect statistics thereto;
- (v) the Government should take effective measures to ensure that simultaneous steps are taken to afforest suitable areas equal to those which have to be deforested on account of the implementation of development projects;
- (vi) urgent steps should be taken by the Centre to carry on a special study of forest grazing in the country, so that a sound grazing policy is evolved. In implementing a sound grazing policy, it is essential to seek the willing cooperation of the villagers;
- (vii) in the matter of shifting cultivation, besides introducing agro-silvicultural measures with the provision of necessary opportunities and facilities, steps should be taken to provide tribals with the alternative means of livelihood*;
- (viii) the feasibility of regulating/restricting rights of local inhabitants under customary laws in certain States by providing suitable assistance to the affected parties may be examined by the Central Board of Forestry; and
- (ix) there is need to provide adequate funds on a continuous basis to achieve the desired results in the development of forests.

41.5.11 We are of the view that there should be two pivotal points on which the national forest policy should rest. One is to meet the requirement of goods, that is, industrial wood for forest based industries, defence, communications and other public purposes, and small timber, fuelwood and fodder for the rural community. The other is to satisfy the present and future demands for protective and recreative

* The Estimate Committee reiterated the recommendations of the Scheduled Areas and Scheduled Tribes Commission (1960-61), commonly known as the Dhebar Commission

functions of the forests. All the requirements must be met in full and self-sufficiency achieved as early as possible. For this purpose, there should not only be dynamic production oriented effort in the forest areas under the control of the Forest Departments as recommended in our Interim Report on Production Forestry—Man-made Forests, but also social forestry programmes initiated in other areas as recommended in our Interim Report on Social Forestry.

41.5.12 Since forest based industries are dependent on forest raw materials, interdependence between forestry sector and forest industries is vital. As forest crops can be harvested only periodically, the forest policy should lay down the need for resource planning taking into account the inevitable time lag which may be from 10 to 30 years or more. Integrated planning for raw material production and forest based industry would have to be one of the basic props of future policy. The new policy must take into account the institutional changes and the infrastructure required for utilisation of the forest raw materials from the point of view of self-sufficiency, reduction in net imports of wood based products and substantial exports of consumer items, like panel products. There are two factors in favour of realisation of this goal—the fact that almost all the forests in India are state owned and that in the centralised planning, it is possible to discourage domestic consumption of a number of forest-based industrial items in order to achieve higher export targets.

41.5.13 The policy should indicate clearly the interrelationship of forest economy with rural and tribal economy. The factors to be considered are: (a) employment, (b) rights of user and (c) involvement of the local people. Employment could be offered as an alternative to rights of user, if forest development is properly organised. There are substantial parts of the country, where protection of forests from human interference is a critical factor. Involvement of the local people in forest development may be useful to contain such forces of destruction. Forestry has a great scope for absorption of rural labour, and at the same time produce an increasing quantity of goods from each hectare of forests. In the primary sector of forest production and management, a substantial part of the development expenditure goes towards creating new employment in the rural sector. The multiplier effect of employment also works to the advantage of the rural sector. One of the approaches to forest development and a realistic assessment of the employment potential may have to be through the formulation of individual projects. Directions and need for this must be reflected in the national forest policy. It is also necessary to indicate new lines of growth in forestry, for instance the collection and processing of minor forest produce for maximising its contribution to the rural employment.

At the same time it should lay the groundwork for meeting the increasing demand of forest produce required in the coming years.

41.5.14 In view of what has been stated above the revised national forest policy of India should be based on the following important needs of the country:

- (i) Managing the forest resources of the country so as to provide maximum goods and services for the well-being of the people and economic progress of the country.
- (ii) Checking denudation and erosion in mountainous regions and catchments of rivers on which depends perennial stream flows, fertility of the land in the catchments and the useful life of dams and reservoirs.
- (iii) Preventing erosion along treeless banks of rivers, and on the vast stretches of waste lands, and arresting the spread of sea-sand on coastal tracts and of shifting sand dunes in the western desert.
- (iv) Maximising forest productivity with a view to meeting the growing demand for industrial raw materials, timber and other forest produce for defence, communications and domestic needs, and to augment employment potential, with the ultimate aim of national prosperity.
- (v) Providing small timber and fuelwood requirements of the rural population.
- (vi) Providing grass and grazing for livestock in forest areas, ensuring that it is not harmful to the forests.
- (vii) Providing recreational and tourist opportunities in the forests without impairment of forest resources including wildlife and the preservation of environmental balance.
- (viii) Creating blocks of forests interspersed with cultivation or by introducing trees in larger numbers in the ecosystem after careful selection for maintaining a healthy relationship between soil, vegetation and animal life and establishing diverse biotic complexes for minimising chances of elimination of, natural enemies of insects and other pests which damage crop monocultures.

41.5.15 Forests must have an adequate share of land for the vital needs mentioned above. We are of the view that no disforestation should be permitted without the approval of the State Legislatures. We have dealt with the land requirement for forestry in the next section.

41.5.16 A functional classification was recommended in the National Forest Policy of 1952 for classification of all forest lands into: (a) protection forests, (b) national forests, (c) village forests, and (d) treelands. This could not be achieved and the Estimates

Committee referred to earlier made some adverse comments on the failure in this regard. Bearing in mind the future demands on the forests, we recommend that functionally all forest lands should be classified into : (a) protection forests, (b) production forests, and (c) social forests. A quick reconnaissance should be done in all the States to subdivide the production forests into : (a) mixed quality forests, (b) valuable forests; and (c) inaccessible forests.* The minor forests** that we have defined in the Interim Report on Production Forestry—man-made Forests should be placed under category 'social forests'.

41.5.17 Forests managed primarily for protection occupy hill slopes, watersheds of rivers, river banks, sea shores and other localities vulnerable to erosion and degradation. Protective influences of these forests, specially on soil and water, should be developed in full by suitably managing the existing forests and providing for their rehabilitation and improvement for maintaining the water balance, control of erosion, prevention of rapid silting or reservoirs and moderation of floods. No felling should generally be permitted in these forests.

41.5.18 Production forests, which are essentially commercial forests, should comprise valuable or potentially valuable timber bearing stands occurring in favourable regions which are indispensable for the development of the country and for meeting diverse requirements of the national economy. The basic policy, so far as forests managed primarily for production are concerned, must be to meet the needs of the existing and developing industries, and for such well-established uses as railway sleepers and local requirements. Future development including creation of large scale industrial plantations should, therefore, be directed to this end. Possibilities should be explored for cultivating plantation crops, like rubber, coffee, cashew, etc. in suitable localities on forest lands, consistent with the objects of forest management. Some States, like Tamil Nadu and Karnataka, are reported to have initiated action in this regard. Underplanting of such crops as turmeric, ginger, cardamom, etc. should be encouraged, wherever possible, with a view to making full use of the forest soil. Production forests should be so

* These sub-classifications have been defined in the Commission's Interim Report on Production Forestry—Man-made Forests, as below : (i) Mixed quality forests—Mixed quality stands are of comparatively low economic value at present but have much higher potential. These forests have a low proportion of valuable or economic species. Their clearfelling and conversion to valuable stands of economic species would result in appreciably higher production within a comparatively short period. (ii) Valuable forests—Valuable stands are yielding substantial revenues at present but are still not producing the optimum return which the site is capable of. Their conversion would lead to a substantially higher outturn and revenue per hectare. (iii) Inaccessible forests—Forests situated in remote areas have remained largely unworked or are partially worked due to lack of infrastructure or high exploitation cost.

** Minor Forests—These are forests which are normally marginal and have been depleted due to over-exploitation and uncontrolled grazing in the past for meeting the local demands of the population. These forests could be improved by application of better inputs.

managed as to progressively realise and then maintain their maximum productivity for meeting various needs of the country such as raw materials for forest based industries, defence, communications, other public purposes and for domestic use. In the management of production forests, the site potential should be determined and realisation of maximum productivity within the shortest possible time should be planned.

41.5.19 The social forests would cover wastelands, *panchayat* lands, village commons and lands on the sides of roads, canal banks and railway lines, which may be brought under forest plantations, shelter-belts and mixed forestry, comprising raising of grass and leaf fodder, fruit trees and fuelwood trees. As mentioned in paragraph 41.5.16, the social forests would also include the 'minor forests' as well as such lands as are dedicated to recreation forestry. It is desirable to create woodlots with irrigation on suitable lands in the command areas of irrigation projects that may come up later. For instance, there are possibilities for creation of woodlots through irrigated plantations in Gujarat in the Narbada River Valley Project area. Such woodlots should be classified under social forests.

41.5.20 The social functions of the forests would be to meet the following needs of the community insofar as they are consistent with other objectives; (a) agricultural timber and fuelwood; (b) grazing and grass; and (c) recreation.

41.5.21 Agricultural small timber and fuelwood should be provided to the rural population at a reasonable price, considering that the viability of rural economy is greatly dependent upon the ready supply of timber needed for agricultural implements, housing and other miscellaneous uses and upon fuelwood as a source of domestic energy. Free supply of forest produce to the rural population and their rights and privileges have brought destruction to the forests and so it is necessary to reverse the process. The rural people have not contributed much towards the maintenance or regeneration of the forests. Having over-exploited the resources, they cannot in all fairness expect that somebody else will take the trouble of providing them with forest produce free of charge. One of the principal objectives of social forestry is to make it possible to meet these needs in full from readily accessible areas and thereby lighten the burden on production forestry. Such needs should be met by farm forestry, extension forestry and by rehabilitating scrub forests and degraded forests.

41.5.22 In view of the role of livestock in India's economy, forest grazing should be allowed. But grazing in forest areas should be strictly controlled and regulated so that it does not interfere with the productive and protective functions of the forests. Grazing should not be looked upon as a source of revenue. A grazing fee should be

charged, but it should not be so small as to encourage the owners of non-essential livestock to bring their animals for grazing in the forest areas. The resources of the forest areas should be utilised only for feeding of the essential livestock. To meet the need of forage of the enormous number of livestock in the country, it is desirable that wherever grasses can be grown in forest lands without detriment to the tree growth, and where an effective demand for grasses exists, such lands should be utilised for grazing and for provision of hay for feeding livestock outside the forests. Grazing by goats in forest lands should not be allowed as the damage caused by them, if allowed to graze, is irreparable. Sheep grazing may be allowed only in specially earmarked grasslands in the forest areas, under strict rotational control.

41.5.23 The recreational uses of forests are becoming increasingly important with economic development and these uses must be enhanced and made available to the public. It should, therefore, be necessary to develop recreational facilities and set apart areas in the forests as far as is consistent with sound forest management. Suitable areas for nature conservation, forest parks and natural areas for scenic, scientific and other purposes should be earmarked and alternative uses should not be allowed therein. Development of wildlife should be as much for recreational forestry as for its scientific importance. For wildlife, we have indicated the principles separately in paragraph 41.5.29.

41.5.24 A large population of tribals live in and around forests. Considerable damage is caused to the forests by them by the wasteful practice of shifting cultivation. It is practised in the same area as long as soil fertility lasts to their satisfaction, from 1 to 3 years at the most. In view of the limited forest area, the rotation is comparatively short. In the second rotation fertility cannot build up to the original level, and erosion also takes place. So for every cycle, the rotation period gets shorter. Increase in the tribal population is also responsible for shortening cycles. With shortening rotation, yield also gets poorer from one cycle to the next. As such, both from the point of view of forest development and economic well-being of the tribals themselves, the wasteful practice of shifting cultivation should be regulated, contained and replaced as expeditiously as possible, by resorting to agri-silvicultural methods apart from other methods. These should be explored, planned and implemented in cooperation with other concerned departments including Tribal Welfare Department. As the shifting cultivation is an age-old practice with the tribals, any programme to regulate shifting cultivation has to form part of the wider plan for tribal welfare.

41.5.25 Tribal welfare should also be ensured by satisfying their domestic needs of various forest products and by recognising the priority

need of their direct employment in forestry operations, so as to establish a better symbiotic relationship between the tribals and the forests. Settled and permanent agriculture need not necessarily be the only policy in regulating shifting cultivation for several reasons. The cost of terracing and preparing the land is very high. The same amount, if invested in the programme of plantation crops, like rubber and coffee, production forestry and development of minor forest produce, can create the requisite level of employment, and hence provide an alternative to shifting cultivation.

41.5.26 Forest resources for forest industries should be developed in regard to the type and quality of the produce both for internal consumption and for export. In potentially productive areas, resources for raw material should be stepped up through large scale industrial plantations in order to foster the growth of forest based industries. A forest production programme in isolation will not succeed. Future production programme must be related to utilisation and the present gap between the forest production and its utilisation bridged. It would be necessary to ensure adequate investment of capital in forest-based industries in keeping with production forestry programmes. In according priority to the industries, the labour component needs to be given the weight. The industries should be located to the extent possible nearer the source of raw material. The establishment of industries should be carefully phased with the allocation of resources for development of forest raw material. The price of the forest produce for the industries should be so fixed as to pay for the cost of clearfelling and plantations, and maintenance of production forests, and leave a profit.

41.5.27 Communications in the forests should be developed and improved so as to utilise the potential of the forests to the maximum extent possible for meeting diverse demands for forest products. The development of communications should be particularly ensured in the inaccessible areas. It would help all sectors of the economy and result in alround benefits.

41.5.28 Scientific and technologically superior exploitation techniques should be adopted to reduce wastage and improve efficiency of conversion. In most cases, the conventional methods of logging result in a high degree of wastage of wood which is a national loss. In the interests of boosting the national economy, it is essential to so exploit the forest areas as to decrease such losses to the minimum.

41.5.29 Wildlife development and environmental balance should be ensured through adequate deployment of funds and personnel. It is essential to afford adequate protection to wildlife and plants particularly of species with dwindling numbers. Wildlife and environment

are things which are not dreams or 'idealistic', but very real, as they have a profound effect on the life of the community. In developed countries people are trying to reconstruct what they have lost in the ecological stature by spending huge sums of moneys. But there are certain things which cannot be brought back, once lost. Wildlife policy should, therefore, form a part of the forest policy, where the development of flora should be as much a part as faunal development. A core area of about 4 per cent of the forest lands in diverse ecological associations should be dedicated to the principal use of nature and wildlife conservation, where only the forces of Nature would have their play. The areas should be carefully selected and so distributed as to embrace varied natural conditions and ecosystems. The core areas should be surrounded by sizeable areas of well managed forests.

41.5.30 The domestic needs of the people living near forest areas for small timber, fuel and fodder are primarily to be met from forests, and these should be provided for in consonance with sound forest management. In order that sufficient raw materials are available to meet industrial needs, after catering to the local domestic needs, adequate resources should be deployed to create farm forests and extension forests, including a large scale development of fuel and fodder reserves on the vast stretches of waste lands that exist in every part of the country.

41.5.31 Adequate funds should be provided for the development of forestry. Forestry is a long term investment. A sustained flow of the necessary funds is indispensable for forest development. Forestry projects oriented towards industrial production should be examined from the basic economic considerations of forest development.

41.5.32 The role of forest research should be accepted as basic to efficient forest management; and adequate funds should be provided for research both in forestry and forest products. Forest research programmes should be based upon a comprehensive analysis of long term needs and consequently on long range planning

41.5.33 Forest education and training of an adequate standard should be facilitated, so that higher efficiency can be acquired by all grades of professional forest Services and forest research workers. Specialisation by professional workers should also be encouraged to foster necessary technological developments in forestry. Facilities of forest education should also be opened in agricultural universities.

41.5.34 Extension and publicity work should be undertaken by the Forest Departments, as this is essential for making the people tree and conservation conscious and for obtaining their goodwill and co-operation for the successful implementation of the policy. No forest policy, however well intentioned and meticulously drawn up, has any

chance of success without the willing support and cooperation of the people. It is also essential to instill in the people a direct interest in the forests and their development. In order that the public becomes conscious about the aims and objects of nature conservation and preservation of environmental values, the States should take steps to include nature conservation and environmental preservation in the curricula of schools and colleges.

41.5.35 Existing legislation on forestry should be strengthened for effective implementation of forest policy. For the sake of uniformity and concerned action for forest development, a revised all-India Forest Act should be enacted.

41.5.36 Forest administration should be strengthened at the professional level. The policy should recognise: (a) the need for rational manpower planning by the Centre and the States, considering that it takes a long time to train and deploy a forester, (b) the need for adequate training and calibre at all levels of forest Services, and (c) the need for coordination of all forest and forest industries activities, particularly the planning of industrial investment in forestry.

41.5.37 Provision of employment of local people through forestry practices should be recognised as an important element. It is, therefore, necessary to encourage direct departmental working or formation of cooperatives of labour engaged in forest works. The forests offer an important field of employment to the local people, both directly in silviculture, management, extraction and utilisation of forest produce, major or minor, and indirectly in the forest based industries. It should be possible particularly to involve the tribals directly in the exploitation of forests and thus improve their economic status. Intermediaries exploit both the forests and local labour for their own benefit and must be supplanted by departmental labour forces or forest labour cooperative societies.

41.5.38 While the discretion of State Governments to regulate the details of forest administration in their respective territories should be left unfettered, the general principles of the national forest policy should be observed by them in framing their detailed policies and legislation for the conservation and utilisation of their land and forest resources. We understand that the CBF is seized with the issue. With a view to obtaining the broadest possible agreement, the CBF should discuss the revised forest policy with the States and Union Territories. After its approval the policy should be legislated by the States. This would be a more effective method than a declaration of a policy by the Government of India.

41.5.39 We have already explained and indicated in detail the approach in respect of a few aspects basic to forest progress in our

Interim Reports on Production Forestry—Man-made Forests, Social Forestry and Forest Research and Education. We have elaborated on the other aspects of the policy in the chapters that follow.

6 LAND REQUIREMENT FOR FORESTRY

41.6.1 According to the statistics obtained from the Central Forestry Commission, forests in India occupied an area of about 74.8 million hectares as in 1970-71. However, according to the agricultural statistics¹ the area under forests in 1970-71 was only 66.0 million hectares. This discrepancy should be reconciled, since area is a basic factor in developing forest resources.

41.6.2 From the figures reported by the Chief Conservators of Forests as regards legal classification of forests in the States, it is noticed that a high incidence of protected and unclassified forests generally result in higher discrepancy in the figures in the two statistics. If the genesis of protected and unclassified forest is examined, the position may become a little clearer. Under the Estate Acquisition Acts, commonly known as *Zamindari* Abolition Acts, vesting of *zamindari* forests in Government took place on the basis of old settlement records. These private forests and those which merged from the princely states were classified as unclassified forests, possibly pending the full processes under the Indian Forest Act, 1927 and the relevant State Forest Acts to take their own course for assimilation of these forests. But more often than not, a paper transaction was made in handing over the forest areas to the Forest Departments for management. Parts of such unclassified forests came later to be declared as protected forests under the relevant Forest Acts, following the old records. Since no demarcation could be made until revisional settlement operations or working plan surveys had taken place, parts of such areas might have been converted into croplands in the meantime. It is quite possible that some erosion of area under forest has taken place later also by their conversion into croplands, submersion in river valley projects, and use in sundry other projects.

41.6.3 The existing national forest policy is primarily a guidance for the management of forest lands under the control of the Forest Department. There is still extensive forest areas, owned by the Government, which are managed by other departments of the Government. It is to be conceded that the management of the forests, not under the control of Forest Departments, can hardly fall in line with

¹ 1975. Indian Agriculture in Brief (Fourteenth Edition). New Delhi, Directorate of Economics and Statistics, Ministry of Agriculture & Irrigation, Government of India.

the principle of conservation and regeneration which a technically qualified Service under the Forest Departments can follow. We are of the view that it should be unequivocally stressed that all forests under the control of other Government departments should be transferred forthwith to the control of the Forest Departments.

41.6.4 The ownership of private forests in the States where they still exist in individuals. Such ownership must be regulated in the national interest so that indiscriminate exercise of individual rights may not prejudice or endanger general welfare, and at the same time the optimum potential from such areas may be realised. Regulation and control of private forests by the States are, therefore, imperative.

41.6.5 The use of land for forestry should undoubtedly be a part of the land-use pattern previously determined. But there would always be some areas under permanent forest cover and some areas under treelands in farm areas and outside, under wind-breaks and shelter-belts etc., though not as a part of regular forests. From a pragmatic point of view, forests must have an adequate share of land for the productive, protective and aesthetic functions. It is of utmost importance that there should be a minimum diversion of forest land for other purposes, and where some diversion does become inevitable, an attempt should be made to make up the loss by bringing some other areas under forests.

41.6.6 Social forestry,* particularly farm forestry and extension forestry, can be the only practical step for increasing the area under forests and treelands. Punjab and Haryana are outstanding examples of this approach. After reorganisation, these States were hardly left with any natural forest cover. Since then they have gradually increased the effective coverage under trees and forests by taking to plantations of canal-side and road-side lands and ravine lands, creation of wind-breaks and shelter-belts, etc.

41.6.7 In view of the urgent need of creating employment opportunities and of meeting the demands of fuelwood and small timber in rural areas, forest lands are to be managed in such a way that (a) capacity of forests for rural employment is fully utilised, and (b) increasing productivity is obtained to satisfy the needs of the rural community and, of course, the industries. It needs also to be emphasised that apart from direct production benefits that forests may bestow, protection afforded by forest cover should be considered as of paramount importance, though benefits are largely indirect and not quantifiable. The quantum of land under forests and tree growth must be sufficient to perform this important function.

* See the Commission's Interim Report on Social Forestry

7 STRATEGY FOR FOREST DEVELOPMENT

41.7.1 The following methods¹ are generally recognised to govern the implementation of a forest policy;

- (i) Forest law to give effect to the forest policy should be enacted in consonance with the judicial norms and customs of the country. Such legislation should be developed in keeping with the economic and social progress of the country, and should in fact anticipate such progress.
- (ii) A Forest Service should be established and staffed by suitably qualified personnel in all the grades to develop and implement forest policy in collaboration with any suitable organisations which may exist, and to administer forest law. There should be an effective organisation to deal with forest research, its coordination and the dissemination of results.
- (iii) Adequate training should be provided for all concerned with the management of forests or the utilisation and processing of forest products. In particular, foresters and allied technicians should be trained in sufficient numbers to staff public services and other interests concerned with forestry and forest products.

41.7.2 As regards forest law, India has a long standing one in the Madras Forest Act, 1882 and Indian Forest Act, 1927. These Acts or their variations have been adopted in different States, some of which have also enacted their own forest legislation. The revisions in the forest Acts needed to bring them into conformity with the forest policy and changed social and economic situations have been dealt with in a later chapter.

41.7.3 Forest administration is charged with the responsibility of implementing the policy and enforcing the forest law. Basically, India had long been following the principles of administration enumerated in paragraph 47.7.1 above, though there was scope for improvement in the form and structure of the administration and in the skills and professional training of the Services. The administration should, therefore, be geared to realise the objectives in the changed economic and social circumstances and to develop strategies to implement the programmes that would be required for future forest development.

41.7.4 It is clear that any strategy for forest development must take into account the goods and services that the forests should provide. Goods and services are both tangible and non-tangible. Production of industrial wood would have to be the *raison d'être* for the

¹ Principles of Forest Policy, as adopted in the Sixth Conference of the FAO held in Rome in Nov-Dec, 1951

existence of forests. Actually it is in this value that many other values that have been claimed or stressed for forests so far can be absorbed. Other tangible benefits are the production of minor forest produce, fuelwood and fodder. Non-tangible benefits are the conservation of soil, moderation of run-off flows, recreation, maintenance of ecological balance, environment and wildlife, though in developed countries parameters are being evolved for evaluating benefits for their economic appraisal.

41.7.5 The first element of the strategy would have to be production forestry for industrial wood production, supplemented by adequate forest based industries, for which necessary institutional and technical changes should be made. This should be based, among others, on the following facets :

- (i) It should be project-oriented and commercially feasible from the point of view of cost and return.
- (ii) The quantum of production should be based on the requirement of future demands, both internal and export, for which purposes infrastructure should be developed with adequate investment.
- (iii) Import of wood based products, particularly paper and pulp, should be obviated by 1980.
- (iv) Export of wood-based products should be stepped up between now and 1980, so that if any import of any class of wood-based products becomes necessary after 1980 it should be more than offset by export.
- (v) Simultaneous development of forest based industries must take place, and plans for forest management and forest industries should go together.
- (vi) Policies for sale and pricing should be so evolved that a commercial rate of return on the investment in the forestry sector is possible, while ensuring optimum development of forest industries.
- (vii) Institutional changes should be brought about in forest management for production forestry.
- (viii) Identification of the areas where production forestry is possible should be done, particularly in heavy rainfall areas, and the priority should be on inaccessible forests followed by mixed quality and valuable forests.

41.7.6 The Second element of the strategy would be the widespread adoption of the practice of social forestry. Social forestry, in the Indian context, should mean more than what is understood by the term in the developed countries. It should not only aim at creating protection and recreation benefits to the community, but should

also include the activities concerned with the growing and meeting of the fuelwood and fodder needs of the rural community in future.

41.7.7 The strategy for forest development should also include programme for improving production, collection and utilisation of minor forest produce (MFP) as an important component of the total forest resource. The MFP is already a fairly good net foreign exchange earner. The tribal people and others living in or around the forests in the backward regions often take to collection of the MFP as their principal means of livelihood. By setting up suitable State agencies for collection, marketing, etc., it would be possible to assure this section of the population employment and a reasonable minimum wage. Many kinds of small scale and cottage industries could also be developed on the basis of MFP.

41.7.8 Efforts towards realising higher production and various other benefits from the forests through production and social forestry and through development of minor forest produce should be guided by the planning objectives. The cardinal principle accepted in Indian planning is that growth should lead to social justice. Growth in forestry should be planned with this principle in mind. For instance, the increased yields of forest products will have to be equitably distributed between industrial needs and the demands of the rural population. With the increase in productivity, there will also be a possibility to earmark areas for grass and fodder development, nature and wildlife conservation, recreation, etc. Furthermore, by virtue of their proximity to the rural populace and their labour intensive character, forests can play an increasing role in rural employment. Steps should be taken to see that such employment go mainly to the socially backward, unemployed and underemployed agricultural labour.

41.7.9 A direct involvement of the local people in the exploitation and marketing of forest produce is called for. At present, the collection, extraction and marketing of forest produce, major or minor, are mostly done by contractors, selected through auctions or tenders. When these works in the forests are done by contractors, who would be guided solely by profit motives, it is likely that (a) the tribals and others engaged by them may not get a fair wage or continuity of employment, (b) attempts may be made to pilfer produce out of the forests, causing loss to Government, and (c) the tribals and others, because of their economic difficulties, may take to illegal feelings in the forests to make a living.

41.7.10 To ensure social justice to the communities living in and around forests, while planning for growth in the forestry sector through the strategies outlined in the previous few paragraphs, it is suggested that :

- (i) The existing system of harvesting of major and minor forest produce through the intermediary contractors must be replaced by taking it up either directly by the State Forest Departments and/or by a network of forest labour cooperative societies or by a combination of both.
- (ii) Where State forest corporations come up, it should be their particular duty to see that works in the forests are done either directly or through forest labour cooperative societies.
- (iii) A strong support from Government to the forest labour cooperative societies, wherever formed, should be given so that such societies become self-supporting and non-exploitative. A trained forest officer of suitable rank should be the executive Officer of each cooperative society.
- (iv) A State Council should be formed in each State under the chairmanship of the Minister in-charge of forests to formulate a phased programme for introduction of the system of harvesting of forest produce in the manner suggested in (i) above. The Secretary of the Council should be a competent forest officer not lower in status than that of a Conservator of Forests.

41.7.11 A careful planning and management of the environment and wildlife, as appropriate, should also be ensured by the Central and State Governments for the benefit of the present and future generations. It should be recognised that forests have a direct relevance to the quality of life and as such should be viewed against their significant environmental value. Forest management should be such that it can effectively contribute towards:

- (i) the moderation of flow of water in the catchments;
- (ii) the protection of the soil against erosion by wind and water, and other forms of soil degradation;
- (iii) the protection of wildlife;
- (iv) the recreational resources;
- (v) the betterment of living conditions both in and around human settlement through improvement of aesthetics, psychological relief, etc; and
- (vi) the maintenance of ecological balance.

It should particularly be borne in mind that wildlife is natural resource of great value to mankind. So the consideration of wildlife resources and their habitats should be incorporated into land-use planning and development. Facilities should also be developed in forest areas to promote tourism based on wildlife resources.

41.7.12 Progress in forestry and related resources management is inevitably based upon knowledge gained through research, such research, both basic and applied, should form the foundation of effi-

cient forest management. The research base is currently very inadequate both at the Centre as well as in the States, and it needs to be completely reorganised and augmented. Neither a programme of research nor any dynamic forestry practice in the field can be implemented without personnel of the required quality and number. The horizon of knowledge in every field of forestry is extending and the forestry personnel should have its full benefit in their training. Therefore, there should be a closer institutional link between research workers and teachers. New concepts of planning and management would require specialists, for which the inservice training should lay the foundation. Most important of all, the universities should be brought into the main-stream of forest research and education.

41.7.13 The key to the future of forest development lies in a complete reorientation of outlook towards forestry practices and in the determined implementation of the programmes formulated. Two distinct facets of the forestry practices must be recognised clearly and accepted without reservation at the highest level of the Government. Production forestry must be a commercial programme. The Government should be prepared to make the necessary investments, for creating adequate protection and recreation benefits and meeting the fuelwood and small timber needs of the rural and semi-urban communities through social forestry, so that production forestry brings a fair net return. It is in this context we would like to mention the specific problem of unauthorised removal of forest produce and encroachment on forest lands by the rural people. This is the real hurdle in the development of forest wealth. In a democratic country, forests can flourish only in a congenial social and economic atmosphere, and not by the imposition of restrictions and legislative measures alone. The implementation of the strategy we have outlined for a balanced development of forest resources would finally depend on the required support at the highest policy and decision making level.

8 SUMMARY OF RECOMMENDATIONS

41.8.1 The more important recommendations made in this chapter are given below :

1. Forests must have an adequate share of land for the productive, protective and aesthetic functions. There should be a minimum diversion of forest land for other purposes, and where some diversion does become inevitable an attempt should be made to make up the loss by bringing some other areas under forests.

(Paragraphs 41.5.15 and 41.6.5)

2. No disforestation should be permitted without the approval of the State Legislatures.

(Paragraph 41.5.15)

3. Functionally all forest lands should be classified into :

- (a) protection forests;
- (b) production forests; and
- (c) social forests.

A quick reconnaissance should be done in all the States to sub-divide the production forests into :

- (a) mixed quality forests,
- (b) valuable forests, and
- (c) inaccessible forests.

(Paragraph 41.5.16)

4. Protective influences of the forests, specially on soil and water, should be developed in full by suitably managing the existing forests and providing for their rehabilitation and improvement.

(Paragraph 41.5.17)

5. The production forests should not be permitted to be diverted to any other forest use. Growing of plantation crops, like rubber, coffee, cashew, etc., in suitable localities on forest lands may be undertaken, consistent with the objects of forest management. Underplanting of such crops as turmeric, ginger, cardamom etc. should also be encouraged, where possible.

(Paragraph 41.5.18)

6. Instead of supplying agricultural small timber and fuelwood to the rural population free or at concessional rates, a reasonable price should be charged.

(Paragraph 41.5.21)

7. Forest grazing should be strictly controlled and regulated for feeding of essential livestock. Wherever grasses can be grown in forest lands without detriment to tree growth, and where an effective demand for grasses exists, such lands should be utilised for grazing and for provision of hay for feeding livestock outside the forests. Grazing by goats in forests lands should be prohibited and that by sheep allowed only in specially earmarked grasslands under strict rotational control.

(Paragraph 41.5.22)

8. Shifting cultivation should be regulated, contained and replaced as expeditiously as possible, by resorting to agri-silvicultural methods apart from other methods. This should be explored, planned and implemented in cooperation with other concerned departments. But regulation of shifting cultivation should form a part of a wider plan for the tribal welfare.

(Paragraph 41.5.24)

9. Tribal welfare should also be ensured by satisfying their domestic needs of various forest products and by recognising the priority need of their direct employment in forestry operations.

(Paragraph 41.5.25)

10. Resources for forest raw materials, both for internal consumption and export, should be stepped up through large scale industrial plantations. An adequate investment of capital in forest based industries should be ensured in keeping with the production forestry programme. The forest based industries should be located to the extent possible nearer the source of raw materials, and their establishment should be carefully phased with the development of forest raw material. The price of the forest produce for the industries should be so fixed as to pay for the cost of clearfelling and plantations, and maintenance of production forests, and leave a profit.

(Paragraph 41.5.26)

11. In inaccessible areas, development of communications should be particularly ensured, so as to utilise the forest potential to the maximum extent possible.

(Paragraph 41.5.27)

12. Scientific and technologically superior exploitation techniques should be adopted to reduce wastage and improve efficiency of conversion.

(Paragraph 41.5.28)

13. Adequate protection should be afforded to wildlife and plants, particularly of species with dwindling numbers. A core area, about 4 per cent of the forest lands, distributed amongst varied natural conditions and ecological associations, should be dedicated to nature and wildlife conservation. The core areas should be surrounded by sizeable areas of well managed forests.

(Paragraph 41.5.29)

14. Forest research should be accepted as basic to efficient forest management, and adequate funds provided for research both in forestry and forest products.

(Paragraph 41.5.32)

15. Extension and publicity work should be undertaken by the Forest Departments, for making the people tree and conservation conscious and for obtaining their goodwill and cooperation. The States should take steps to include nature conservation and environmental preservation in the curricula of schools and colleges.

(Paragraph 41.5.34)

16. Existing legislation on forestry should be strengthened for effective implementation of forest policy, and a revised all-India Forest Act enacted.

(Paragraph 41.5.35)

17. Forest administration should be strengthened at the professional level. The forest policy should recognise the need for:

- (a) rational manpower planning by the Centre and the States;
- (b) adequate training at all levels of forest Services; and
- (c) coordination of forest and forest industries activities, particularly the planning of industrial investment in forestry.

(Paragraph 41.5.36)

18. Provision of employment of local people through forestry practices should be recognised as an important element, and all forestry works should be carried out either departmentally or through forest labour cooperative societies.

(Paragraph 41.5.37)

19. After obtaining the approval of a draft of the revised National Forest Policy by the Central Board of Forestry, it should be legislated by the States.

(Paragraph 41.5.38)

20. All forests under management of other departments of the Government should be transferred forthwith to the Forest Departments. Regulation and control of private forests by the States are imperative.

(Paragraphs 41.6.3 and 41.6.4)

21. Social forestry, particularly farm forestry and extension forestry, should be adopted for increasing the tree wealth.

(Paragraph 41.6.6)

22. Steps should be taken to see that the increasing rural employment, created through production and social forestry and through development of minor forest produce, goes mainly to the socially backward, unemployed and under employed agricultural labour.

(Paragraphs 41.7.8 to 41.7.10)

APPENDIX 41.1

(Paragraph 41.4.8)

Scheme-wise Expenditure incurred on Forest Development Schemes in India¹

Scheme	(rupees in lakhs)						
	1	2	3	4	5	6	7
	First Plan 1951-56	Second Plan 1956-61	Third Plan 1961-66	Annual Plan 1966-69	Total 1951-69	Fourth Plan 1969-74	
I. State Schemes & Centrally sponsored schemes—							
1. economic plantations for industrial & commercial uses	111.91	486.88	1,163.16	934.01	2,695.96	2,014.99	
2. rehabilitation of degraded forests.	16.42	199.23	380.58	229.84	826.07	322.17	
3. farm forestry-cum-fuelwood plantations . . . . .	..	..	109.54	151.93	261.47	361.25	
4. development of minor forest products . . . . .	..	..	151.74	148.09	299.83	107.44	
5. communications	42.27	247.65	555.98	335.50	1,181.40	553.01	
6. consolidation of forests (including survey and demarcation)	14.63	61.83	199.30	194.19	469.95	367.75	
7. development of pastures and grazing . . . . .	..	..	52.93	47.13	100.06	77.82	
8. nature conservation . . . . .	..	99.52	175.07	125.32	399.91	445.32	
9. training of staff	41.75	74.00	178.43	136.49	430.67	147.83	
10. timber operations . . . . .	..	..	285.77	246.97	532.74	554.19	
11. forest protection . . . . .	..	..	107.03	62.79	169.32	115.25	
12. working plan organisation . . . . .	..	..	121.55	100.90	222.45	132.91	
13. forest research . . . . .	..	..	25.61	46.64	72.25	156.27	
14. publicity . . . . .	..	..	14.03	13.44	27.47	47.41	
15. establishment of statistical cell and planning cell . . . . .	..	..	..	13.55	13.55	38.63	

16. construction of buildings . . .	43.97	115.27	247.40	149.94	556.58	405.99
17. amenities to staff and labour . .	..	..	48.05	14.63	62.68	31.10
18. intensification of management . .	..	..	..	20.57	20.57	29.43
19. cultural operations . . .	..	..	..	42.89	42.89	71.33
20. plantation of quick growing species	..	..	406.48	939.45	1,345.93	1,685.59
21. forest resources survey . . .	..	..	32.11	34.47	66.58	101.92
22. miscellaneous schemes NES . . .	478.83	738.28	248.54	95.47	1,561.12	821.79
ii. Central schemes.—						
1. forest research institute & colleges .	..	41.85	17.39	27.45	86.89	101.29
2. Delhi zoological park. . .	..	56.20	34.67	6.43	97.30	22.75
3. preinvestment survey of forest resources	..	..	8.17	71.54	79.71	143.14
4. logging training project . . .	..	..	3.06	16.19	19.25	35.44
5. scheme-wise details not available .	100.00	..	..	..	100.00	6.85*
TOTAL . . .	849.78	2,120.81	4,593.59	4,205.62	11,769.80	8,898.86

* Annexures II, V and VII of the Report of the Working Group on Forests, Ministry of Agriculture, October, 1972.

* made up of 'Project Tiger'—Ra. 2.55 lakhs, and 'Development of selected National Parks and Wildlife Sanctuaries'—Ra. 4.30 lakhs.

APPENDIX 41.2

(Paragraph 41.5.5)

The Composition and Functions of the Central Board of Forestry and its Standing Committee

A. CENTRAL BOARD OF FORESTRY :

Resolution of the Government of India in the Ministry of Agriculture No. 6-20/48-FD dated the 19th June, 1950, as finally amended in the resolution of the Ministry of Food & Agriculture No. 3-5/69-FD dated 5th February, 1973.

With a view to ensuring an all-India angle in the integration of forest policy pursued by the various States, the Government of India have had under consideration the need of constituting a Central Board of Forestry in the light of the recommendations made by the Conference of Ministers of States, held at New Delhi in September, 1948. Quite apart from acting as a common pool of experiences gained throughout the Union, the Board will serve to secure close coordination in forestry matters and more specially in integrated land-use and help in maintaining adequate standards in forestry education. In addition, it will stand in good stead in forging a common bond between the aims and ideals of inspiring the various Forest Departments of the Union.

With the urge for the industrial and agricultural development of the country generated by recent constitutional changes, forestry, has come to assume a vital role calling for concerted action in such inter-State matters as soil conservation and flood control measures, development of industries and standardisation of timbers, evolution of forest management and legislation for the control of private forests, regulation of river valleys and preservation of tree growth in headwaters.

The Board has accordingly been constituted as under :

- | | |
|---|---------------|
| 1. Union Minister for Agriculture | Chairman |
| 2. Union Minister of State (in-charge of Forestry) | Vice-Chairman |
| 3-26. Ministers in-charge of Forests,
Andhra Pradesh, Assam, Bihar, Gujarat,
Haryana, Himachal Pradesh, Jammu & Kashmir,
Kerala, Madhya Pradesh, Maharashtra, Manipur,
Meghalaya, Mysore*, Nagaland, Orissa, Punjab,
Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh,
West Bengal, Delhi, Goa, Daman & Diu,
Mizoram. | Members |
| 27. Chief Commissioner, Andaman & Nicobar Islands | Member |
| 28. Chief Commissioner, Arunachal Pradesh | " |
| 29. Chief Commissioner, Chandigarh Administration | " |
| 30. } Members, Lok Sabha | " |
| 31. } | " |
| 32. Member, Rajya Sabha | " |

* Renamed Karnataka.

33. Secretary, Ministry of Agriculture, (Department of Agriculture)	Member
34. Inspector General of Forests	"
35. President, Forest Research Institute & Colleges Dehra Dun	"
36. Secretary, Central Forestry Commission	Secretary

Chief Conservators of Forests and Secretaries to the State Governments may attend along with the members of the Board representing the States concerned.

Functions :

The functions of the Board will be as follows :

1. Coordination and integration of forest policy pursued by States in the management of their forests.
2. The adoption of conservation measures affecting forest resources and soil.
3. Integration of plans for land-use and national reconstruction in which forestry has to play a progressively important role.
4. Promotion of legislation considered necessary for various States for the management of private forests.
5. Regulation and development of forests in inter-State river valleys, which are the concern of the Central Government (vide item No. 56 in the List I of the Seventh Schedule of the Constitution of India).
6. Maintenance of adequate standards of the training of officers.
7. Coordination of forest research conducted in Central and State Institutes.
8. Any other matters affecting forestry which are governed and relevant to the objective of this Board.

Rules of Business :

The business of the Board will be governed by the following rules :

1. The Board shall meet at least once in a year.
2. The Board may appoint technical committees to consider such inter-State matters as training of officers, standardisation of timbers, flood control, antierosion measures, etc.
3. Matters of urgency may be circulated to the members of the Board to elicit opinion.
4. The Secretary will fix the date, time and place for every meeting of the Board. The agenda will be circulated at least 6 weeks in advance.

B. (i) Standing Committee :

Resolution of the Government of India in the Ministry of Agriculture No. 3-5/69-FD dated 30th May, 1972.

In view of the constitutional changes in the status of some of the Union Territories, and the creation of some of new States/Union Territories, the Government of India, in partial modification of the earlier orders contained in the then Ministry of Food & Agriculture (Department of Agriculture) letter No. 3-47/58-FD dated 12-11-58, as finally amended vide Ministry of Agricul-

ture (Department of Agriculture) Resolution No. 3-5/69-FD dated 9-12-1971, have decided to re-constitute the Standing Committee of the Central Board of Forestry, as follows :

1. Union Minister of State (in-Charge of Forestry) . . . Chairman
2. Union Deputy Minister for Agriculture . . . Vice-Chairman
3. One State Minister for Forest from each of the four zones constituted as under (to serve on the Committee in rotation).
 - (i) Eastern Zone : Assam, Bihar, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Tripura, West Bengal (Arunachal Pradesh and Andaman & Nicobar Islands will be grouped with this zone for pre-Standing Committee meetings).
 - (ii) Northern Zone : Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab and Uttar Pradesh (Delhi and Chandigarh will be grouped with this zone for pre-Standing Committee meetings)
 - (iii) Western Zone : Gujarat, Madhya Pradesh, Maharashtra, Rajasthan and, Goa, Daman & Diu
 - (iv) Southern Zone : Andhra Pradesh, Kerala, Mysore* and Tamil Nadu
7. Secretary to the Government of India, Ministry of Agriculture (Department of Agriculture) . . . Member
8. Inspector General of Forests . . . Member
9. President Forest Research Institute & Colleges, Dehra Dun . . . Member
10. Secretary, Central Forestry Commission . . . Member Secretary

(ii) Functions of the Standing Committee as per resolution of the Committee in its meeting held in September, 1958 :

The functions of the Standing Committee will be :

- (i) to assess the progress made in the implementation of recommendations of the Board;
- (ii) to consider any difficulties experienced by State Governments and make recommendations to them as well as to the Central Government with reference to the resolutions of the Board;
- (iii) to appoint special Committees as may be found necessary for any of the above purposes or for studying any connected question; and
- (iv) generally, to assist in the fulfilment of the functions of the Board.

* Renamed as Karnataka now.

APPENDIX 41.3

(Paragraph 41.5.7)

Central Board of Forestry's Important Recommendations on Some Articles of Forest Policy of 1952

Subject	CBF's recommendation
1	2
<p>1. Claims of neighbouring communities—The use of forest products by the village communities in the neighbourhood of a forest should in no event be permitted at the cost of national interests. While the needs of the local population must be met to a reasonable extent, national interests should not be sacrificed.</p>	<p>(i) No occupancy or permanent right should be conferred upon the forest villagers settled in the forests.</p> <p>(ii) Necessary financial provision should be made by the Government concerned to pay compensation to the Forest Department for planting an equivalent area, when forest area are taken up for mining operations, or for planting up abandoned mines.</p>
<p>2. Relinquishment of forest lands for agricultural purposes—The notion widely entertained that forestry, as such, has no intrinsic right to land but may be permitted by sufferance on residual land not required for any other purpose has to be combated.</p>	
<p>3. Land use—A system of balanced and complementary land use should be evolved, under which each type of land is allotted to that form of use under which it would produce most and deteriorate least.</p>	<p>(i) Each State should set up a high powered Board, to regulate the land use policy on the principle of rational land use. After such Boards are constituted no land should be diverted from present use without proper scrutiny by the Board.</p>
<p>4. Protection forests—An immediate and speedy programme is required for the reconditioning of the mountainous regions, river valleys and coastal lands by establishing protective forests over large areas and preserving the existing ones. The production and exploitation of timber in such protection forests should be done within the limits of safety.</p>	<p>(i) In respect of soil conservation measures and afforestation activities in relation to soil conservation, provisions for the measures should be made in the upper catchments of river valley projects. All fringe and other tree planting aimed at reduction of siltation of the lakes should be treated as part of the reservoir project and a fund provision, of 2 to 5 per cent of the estimated cost of reservoir project itself should be made for such protective planting.</p>
<p>5. Reconditioning of hill and dales—The progressive denudation of hill sides with serious repercussions on the fertility of the land demands immediate attention.</p>	

APPENDIX 41.3 (Contd.)

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- (ii) Forest Department of the State concerned should be associated with the initial stages of planning of any River Valley Project.
- (iii) The Soil and Water Conservation Division and the Forestry Division of the Ministry of Agriculture should undertake a comprehensive review of the ongoing programmes in the catchment areas, recommend new programmes to be undertaken and lay down priorities for allocation of funds between the preventive measures in the form of soil conservation and protective afforestation and curative measures such as embankments and other engineering structures.
6. National Forests—Future development in the national forests should be to attain national self-sufficiency in the vital supplies of wood for industry and of large timbers for defence, communications and other national purposes. Cultivation should not be permitted to encroach upon these valuable timber bearing tracts.
- (i) Ways and means should be devised to secure sustained supplies of raw material to paper, match and plywood industries by evolving a formula which may eliminate unhealthy competition and supplementing existing resources by planned plantations.
- (ii) Government of India should set up a Central Organisation for the assessment and rational allocation of the forest resources of the country for the various industries and such other functions as are considered necessary.
- (iii) The reservation of *semul* and preferential treatment in respect of supplies to the match industry should be done, while ensuring that the Forest Departments get a reasonable price for the matchwood raised by them.
- (iv) The States should devise measures to ensure continuity of
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APPENDIX 41.3 (Contd.)

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supplies of raw materials in order to sustain and encourage the development of industries based on forest produce, reserve specific areas for the paper industry, adopt a rational method of price fixation and develop roads in such forest areas.

- (v) A Central Coordinating Agency under the direction of the Inspector General of Forests should be established for the better marketing of timber and other forest produce both internally and for export.
- (vi) Development of forest industries would be provided for under the Ministry of Commerce & Industry and would be mostly in the private sector.

7. Village Forests—The management of village forests should aim at meeting the present as well as the future needs of the local population in respect of small timber for housing and agricultural implements, firewood, leaves for manure and fodder, fencing thorns, grazing and edible forest products. The supply for such requirements should be made available at non-competitive rates. The expenses for development and maintenance of such forests must come from their own income.

8. Treelands—It should be necessary to make the whole nation 'tree conscious' to stimulate private efforts at tree planting.

9. Scope for increasing treelands—With a view to enlargement of treelands, a concerted effort is needed on the part of various Governments and other agencies towards planned afforestation on lands at the disposal of Defence, Railways, Public Works Departments, Universities and Colleges,

(i) The working of, and distribution of the produce obtained annually from the *panchayat* forests should rest in the *panchayats* who would look after the financial aspect thereof.

(i) State Governments should maintain sufficiently large nurseries for fruit, fuel, forest and ornamental trees, for making the seedlings easily available to the public at nominal prices.

(ii) When private individual is allowed to plant a tree on Government lands, e.g. road

APPENDIX 41.3 (Contd.)

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2

Boards, Municipalities and other local Authorities, Associations and Institutions.

side, it will be desirable for the State Governments to allow the planter to enjoy the use of fruit of the tree under stated conditions.

- (iii) There is need for afforesting vacant lands adjoining railway lines and around railway stations in collaboration with the State Forest Departments. All available lands suitable for afforestation in ravines, canal banks and roadsides should be transferred to the Forest Departments so that large areas could become available for plantation under efficient forest management.

10. Treelands in agricultural areas—A campaign inducing villagers to plant trees in village commons and along roadsides on the condition that they would enjoy the benefit of the fruits, timber and other produce of trees planted by them is well worth and extended trial.

- (i) An integrated scheme of crop husbandry, irrigation and land-use based on land capability and land-use survey should form the basis of farm forestry. Farm forestry work should be integrated with the activities of the National Extension Community Blocks, and should form one of the important items of rural development.

- (ii) Extension forestry—farm forestry should be popularised through a suitable extension agency and by providing incentive for planting and protecting trees. Coordinated research projects in different aspects of extension forestry—farm forestry should be undertaken on a priority basis.

11. Wildlife—Bird and animal life should be controlled by special laws and rare fauna preserved by setting up sanctuaries and large scale national parks.

- (i) Considering the need for uniformity of game laws and rules in adjacent States, the Centre should examine the relevant

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rules in different States and consider the possibility of framing a uniform pattern of rules which might be adopted by all the States of India.

- (ii) A separate management plan may be drawn up for national parks, wildlife sanctuaries and nature reserves. In the working plans of other forest areas a separate chapter on wildlife may be incorporated.

12. **Grazing**—Efficient forest management requires that grazing should be regulated as regards the time and place and also the number of cattle admitted.

- (i) Each State should take suitable measures to control grazing in forest areas. The State Governments should have grazing settlement in forest areas and should prohibit camel and goat grazing in such areas.

13. **Sheep and Goats**—Restrictions should be imposed on sheep grazing in forests, and goats should be totally excluded therefrom.

- (ii) A fair portion of Government wasteland, which are not fit for economic cultivation and are still outside the forest boundary, should be placed at the disposal of the Forest Department for the sole purpose of raising fodder reserves.

14. **Sustained yield**—There should be scrupulous regards for sustained yield in the management of all classes of forests. The fluctuations in the annual outturn of forests should be confined within the narrowest limits. Each State should set up a permanent organisation to deal with working plans.

- (i) All States should undertake a detailed survey of the resources and programme inventories of the existing growing stock. Setting up of at least one Forest Resources Division in each State should be done as a Plan scheme for carrying out the resources survey on a priority basis.

- (ii) Integrated long term planning which includes reproduction, harvesting, construction of roads, mechanisation, labour supply and industrial utilisation of forest produce

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should constitute an integral part of intensive management of valuable stands of forests.

- (iii) Regional Commission of the Central Forestry Commission should draw up Regional plans in consultation with the State/ Union Territories of the concerned region.
- (iv) An organisation to undertake a national forest inventory may be constituted. A cell for conducting a national timber survey should also be constituted.

15. Forest legislation—The States without a proper forest Act should enact legislation at an early date on the lines of the Indian Forest Act, or validate that Act for their territory.

- (i) Whereas uncontrolled sale of *biri* leaves on private lands is detrimental to the *biri* industry and is prejudicial to the interests of workers engaged on it, special legislation may be enacted by the States concerned to control the sale and trade in *biri* leaves, and the legislation so enacted should follow a common pattern. Advantage may be taken of the legislation to include other items of minor forest product if considered feasible.
- (ii) State Governments should initiate action for amending their Forest Acts, as per recommendations of the sub-committee of the Standing Committee of the CBF, as modified by the Ministry of Law and the Ministry of Heavy Industries & Mines.
- (iii) A coordination committee for *tendu* leaves consisting of the representatives of the concerned State and representative of the

APPENDIX 41.3 (Contd.)

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Government of India should be established for coordinating activities of the States in regard to collection, transport and marketing of this product. A coordination committee for rosewood consisting of the representatives of the States of Tamil Nadu, Karnataka and Kerala and representative of the Government of India should be constituted to study the issues, regarding its export, exploitation, transport and sale in the concerned States.

16. Forest Education—Forestry courses for Forest Rangers and superior officers at the Forest Research Institute & Colleges should continue, as the decentralisation of forest education will militate against economy and efficiency, encourage fissiparous tendencies, create unemployment and render planned development of forest resources difficult.

(iv) Considering that there is a need to revise the Indian Forest Act, 1927 and make it as uniform as possible, a draft resolution should be circulated to the States for adoption by the State Legislatures under Article 252(1) of the Constitution.

- (i) There will be no objection to admitting not more than 4 trainees to the Diploma Course, sponsored by well established industries, provided the concerned industries agree to pay in advance the capitation charges.
- (ii) The course of training of the Forest Officers at Dehra Dun should include specialisation in a selected sphere.
- (iii) Short courses on specialised topics in forestry should be arranged at the FRI & Colleges for forest officers and Forest Rangers in order to acquaint them with the development in different fields of forestry.

APPENDIX 41.3 (Contd.)

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17. Services—Inadequacy of technical personnel and weakening of the professional standards of the men called upon to manage forests should be avoided so as not to result in reduced output of forest produce and in deterioration of physical conditions.

18. Forest Research—A research organisation in each State commensurate with its resources and requirements should continue to be maintained in the interests of efficient forest management of the country as a whole. Research in the utilisation of forest products should continue at the Forest Research Institute, Dehra Dun, as this balanced arrangement would ensure both efficiency and economy.

(iv) The wildlife training course conducted by the Forest Research Institute should be extended from the existing six months' duration to eight months' duration, followed by a period of two and a half months to be spent in respective States for field study and preparation of dissertation.

(i) A cadre of Forest Extension Service should be built up for Farm Forestry.

(i) The possibility of financing forest research covering a particular region on a contributory basis of 50 : 50 as between the Centre and States concerned should be examined. The importance and necessity of setting up regional research centres as an adjunct to the FRI, Dehra Dun in different parts of the country for tackling problems of a regional nature is recognised.

(iii) The State Governments should strengthen their existing research organisations so as to be able to intensify research on purely local problems.

(iv) The Dry Zone forms a very important part in the country as a whole. It is necessary that each State organise and conduct fundamental and applied research regarding various aspects of dry zone afforestation.

(v) Steps should be taken to give opportunities to ser-

APPENDIX 41.3 (Contd.)

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ving forest officers for carrying on research and achieving specialisation, if any of them have the necessary aptitude.

(vi) There should be a coordinated programme of utilisation research in the State and at the FRI and the coordinating agency for this purpose should be the FRI.

(vii) Research activities in general and genetics in particular, both at the Central and the States' levels should be intensified, and a greater coordination between them secured.

(viii) Opportunities for pursuing research activities by enthusiastic forest officers should be provided by creating supplementary posts both in the States and at the Forest Research Institute.

19. [Liaison with Industry—Utilisation of the results of research on forest products by commercial and industrial interests should be secured, and closer contact established between them.

(i) For manufacturing of pulp and paper from admixture of hardboards available in the country, the FRI should not only conduct experiment but also study the economics in collaboration with industries, if necessary.

20. Popular goodwill, cooperatives and forest workers—A direct interest in the people in the utilisation of forests should be installed. Intermediaries who exploit both the forests and local labour may be supplanted gradually by Forest Labour Co-operative Societies.

(i) In preparing vided textbooks for schools and colleges, simple lessons relating to forestry should be included with a view to creating interest in trees, forests, wildlife, animals, etc. in the minds of young boys and girls.

(ii) Mechanisation in forestry should come without throwing out the existing employees.

APPENDIX 41.3 (Concl'd.)

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<p>21. Forest budgets—The creation of a sinking fund by investing a portion of the revenue in Government securities, more particularly during boom years, would not only ensure availability of funds for replacement and development costs, but may also be made to act as an equalisation fund to be drawn upon in lean years.</p>	<p>particularly in view of the larger forestry development programmes.</p> <p>(iii) Early steps should be taken to promote the formation of forest labour cooperative societies to replace contractors in forest exploitation progressively.</p> <p>(iv) A suitable organisation should be set up at the Centre for coordinating forest publicity in different States and to make available forestry films and other publicity literature to the State Governments.</p> <p>(i) It should be examined whether the existing credit facilities from institutional agencies including those provided by Agro-Industries Corporations are satisfactory for financing various viable forestry development programmes or whether an independent set up is necessary.</p>

PRODUCTION AND SOCIAL FORESTRY

1 INTRODUCTION

42.1.1 Demand for forest products is growing rapidly in all countries — developing and developed. In India, a large gap between the requirement and supply has appeared, which is likely to widen unless forestry is lifted from the current low-investment low-yield practices. Dynamic production and social forestry programmes would have to be adopted, aimed at meeting the future needs of industrial wood for forest based industries, defence, communications and other public purposes and small timber, fuelwood and fodder of the rural community, at the same time creating protection and recreation benefits.

42.1.2 There is an outgo of substantial foreign exchange for import of newsprint, paper and paperboard and pulp. World prices are rising sharply, and for this reason too import should be obviated in the shortest possible time. The steadily mounting demand of timber and processed wood products abroad has created a favourable climate for this country to enter the world market more aggressively. We have, therefore, not only examined the domestic requirements of forest raw material other than minor forest produce in this chapter and indicated steps to be taken to meet them, but also the possibilities of export and the steps required to be taken for export promotion.

42.1.3 It is no doubt that lack of adequate investment has been mainly responsible for the slow development of forestry including creation of man-made forests on a far larger scale than has hitherto been possible. These also reflect other factors which have prohibited the flow of adequate finance in the field of forestry. In the Interim Report on Production Forestry — Man-made Forests, we have dealt with (a) institutional obstacles, (b) pricing policy and (c) absence of a link between forestry and forest industries. In this chapter, we have discussed the different aspects that may impede a coordinated growth of forestry and a few important forest based industries, the inputs that are necessary and the need for amendment of tax laws that may effect dynamic production and social forestry programmes. We have also discussed how far the existing system of sale of forest products should

be modified in order to provide sustained employment at reasonable minimum wages to the weaker sections of the population. A projection has been made of the manpower needs, so that it can be planned properly.

42.1.4 Several other issues discussed in this chapter relate to increased production and productivity from forest areas and to the role of forests in increasing production in other agricultural sectors. Diseases and insects take a considerable toll of the productivity, usefulness and value derived from the forest resources. Control measures are essential, particularly in the case of man-made forestry programmes. In view of the role of livestock in the country's economy, grazing in the forests would have to be allowed, though it has to be controlled and restricted. The chapter elaborates our suggestions in this respect, and also in the matter of coordinated grassland and livestock improvement programmes. We have examined how the economic well-being of the tribals can be assured in forest development programmes. In this context, the problem of shifting cultivation, acute in several regions of the country, and its solution have been discussed in some detail. In increasing production in various agricultural sectors, the role of forestry in soil and water conservation assumes some importance. In this chapter, we have indicated the steps necessary to tackle (a) degraded lands in the river valley catchments, (b) ravine lands, (c) *cho* lands, etc.

42.1.5 In the face of sharply rising demand, attempts should be made to bring into productive use the forests inaccessible at present, but potentially productive. In some cases, mechanisation will be inevitable, as in the case of hill forests or for removing any impediments in opening up of inaccessible forest areas. A higher tempo of forest road construction is also called for. In this chapter, we have examined the extent to which mechanisation can be pursued in forestry, and have given an idea of the magnitude of the road construction programme that ought to be taken up. Some of the inaccessible areas, like Andaman & Nicobar Islands, may present special problems of development. The resource appears substantial, and how to develop it has been dealt with in this chapter. Production of timber and fuel, development of grazing facilities, etc. are the special problems in desert areas. In this chapter we have also dealt with some relevant aspects of the cold desert areas of Ladakh in Jammu & Kashmir and Lahaul-Spiti in Himachal Pradesh, the development problems of hot desert areas having already been discussed in our Interim Report on Desert Development.

2 DEMAND AND SUPPLY PROJECTIONS

42.2.1 Forestry is a Primary production sector from where the products are processed in one or more stages before final consumption. The projections of demand and supply have, therefore, to be reduced to the primary forest products. The production can be assessed in two different ways: (a) from recorded sources of origin in the forests, or (b) by working back from the finished products consumed in the market. Production of commodities like timber and logs can be assessed from recorded sources, whereas the requirements of sophisticated and organised industries, like pulp and paper etc., can be worked back from the output of these industries. Substantial production may, however, escape accounting as a large quantity is utilised near the source without finding a place in any of the recording systems. Large quantities of wood and other products are produced outside the forestry sector on farm lands and wastelands. All these have to be accounted for if comprehensive planning in the forestry sector is desired. In order to get a perspective on the demand for planning the productive uses of forests, it is necessary to analyse the potentialities of export of wood and other processed wood products. We have dealt with the export potentialities in Section 4 below, and in this section we only discuss the domestic demand and the prospects of supply from indigenous sources.

Demand for Industrial Wood

42.2.2 Many studies have been made in the past on timber and fuel trends and prospects. Timber Trends Survey¹ estimated the industrial wood requirement for 1960, 1970 and 1975. Von Monroy² and Venkataramany³ projected the demand of industrial wood for 1960, 1965, 1970 and 1975. In September 1965, the Ministry of Agriculture & Irrigation (Department of Agriculture) drew an Indicative Plan for Forestry in India for the period 1965-1985 as part of the Indicative World Plan sponsored by the Food and Agriculture Organisation (FAO) of the United Nations. The Plan showed that the total industrial wood requirement would rise from 14 million m³(r) in 1970 to 22, 32 and 50 million m³(r) in 1975, 1980 and 1985 respectively.

¹ 1958. FAO/ECAFE Timber Trends Study for the Far East, Country Report for India, New Delhi, Ministry of Food & Agriculture, Government of India.

² Von Monroy, J.A., 1960. Integration of Forests and Forest Industries. Rome F.A.O.: Report No. 1298.

³ Venkataramany, P., 1962. Timber Trends and Prospects in India 1960-1975, New Delhi. Ministry of Food & Agriculture, Government of India.

42.2.3 A study on the subject was undertaken a few years back by the Ford Foundation consultants to the Planning Commission and the document prepared by them, titled "Forest Products Production — Trade, Consumption and Quantity and Value of Raw Materials Requirement", was specifically discussed in detail by the Chief Conservators of Forests and others interested in forest and forest industries development at a Seminar on "Forest Project Planning for Economic Development" held in December, 1971 at Dehra Dun. In this study based on the population growth and per capita Gross Domestic Product (GDP), consumption patterns including the impact of imports and exports were worked out. Detailed break-up had been made separately for sawnwood, coniferous and broad-leaved, sleepers for railways, plywood, veneer, particle board and fibreboards. Separate studies were also made for various kinds of pulp and paper products from different raw materials, like hardwoods, conifers, bamboos and other fibrous materials. The requirement of pit props, poles and fuelwood were separately prepared and identified.

42.2.4 The sectoral analysis referred to above has used the production data provided by the Central Forestry Commission which are in turn based on the statistical returns from the States. A critical examination of this source of data and those from other sources like the studies by the Planning Commission and the Ministry of Industry & Civil Supplies indicated certain possibilities of errors and gaps due to non-reported production. Some production of timber/wood from non-Government forests and from agricultural lands appear to have been omitted. These and other errors that might have cropped up in the calculation and other relevant information in respect of various products were duly examined by us and the demand projections for 1980 and 1990 were incorporated in our Interim Report on Production Forestry — Man-made Forests submitted in August, 1972.

42.2.5 We have since carefully analysed the possible levels of economic growth and growth of population by the turn of the century. These are discussed in detail in Chapter 10 on Demand Projections. Since the population and GDP projected by us now are substantially different from our assumptions at the time of preparing the Interim Report, we have taken a fresh look at the demand of industrial wood for 1980, 1985 and 2000 AD. So far as sawnwood, panel products and roundwood are concerned, we have assumed the same income elasticity of demand till 1985 as in the Interim Report. After 1985, relative consumption of sawnwood and roundwood is most likely to go down, as more panel products come to the market and changes in construction design of houses are brought about. In the absence of any reliable

past data on consumption, we have assumed that the income elasticity of demand for sawnwood would decrease from 0.8 to 0.6 and that for roundwood from 0.5 to 0.25. Hence, for these two categories of products the national forest survey organisation that we have proposed to be set up (vide Chapter 46 on Forest Planning, Research and Education) should undertake studies on consumption trend for the next ten years and revise the target on more realistic data. As regards pulp and paper, the basis for our estimates for 1980, 1985 and 2000 AD has been explained in the technical note appended (Appendix 42.1). We have made two estimates of demand of industrial wood — high and low — corresponding to the two estimates of GDP.

42.2.6 The use of wood as a pulping material is universally accepted as its widest industrial use; but in India wood as a raw material for pulping has not yet found the anticipated dimensions. This is mainly because the paper industry started on materials different from wood, like grass, rags and other waste material. In the more recent past, bamboo dominated the scene and still is in a dominant position. The shortage of all these conventional materials has now shifted the demand towards other raw materials, particularly hardwoods. Large scale plantations of fast growing species like eucalypts have substantially altered the wood raw material supplies for pulp. With these changes, the past pattern of use of raw materials for pulping could not be taken as a guide for the future. Moreover in most of the State statistical returns, pulpwood is not recognised as a separate category. Considerable technological changes have been assumed in the use of pulp mix for different grades of pulp and paper. We have however discussed the effect of technological changes on forest materials consumption in Section 5 of this chapter.

42.2.7 As regards pulp mix, we have assumed that in 1985 it would be the same as for 1980. Based on the above assumption, we have calculated the different categories of pulp and raw material required in 1980, 1985 and 2000 AD. In calculating raw material requirement, we have assumed that technology would improve in the period 1985-2000 AD to increase pulp production per unit volume of wood. These estimates of demands, along with those on account of sawnwood, panel products, matchwood and roundwood, are shown in Appendices 42.2 and 42.3. In addition to pulpwood and bamboos, waste paper would be recycled in the pulp and paper industry and bagasses and other agricultural residues used. The total demand of raw material other than pulpwood is shown in Table 42.1 :

TABLE 42.1

Estimated Requirement of Raw Material other than Pulpwood for Pulp and Paper

(in '000 tonnes)

Item	High estimate			Low estimate		
	1980	1985	2000 AD	1980	1985	2000 AD
bamboo	2,165	3,123	3,546	1,907	2,352	1,936
bagassee	57	82	720	49	63	367
waste paper, agricultural residues and others	381	538	2,285	337	430	1,140

Demand for Fuelwood

42.2.8 Fuelwood is an item of production in the forestry sector showing the greatest gap between the reported figures of consumption and that studied from the end use. It is recognised that the recorded production is hardly 10 per cent of the total requirement. Since the presentation of our Interim Report on Production Forestry — Man-made Forests, in which we had projected the requirement of fuelwood till 1990, we have examined some other studies and also considered the revision in population projection. We have recast the requirement of fuelwood as outlined below.

42.2.9 It has been estimated¹ that in 1970-71, the total consumption of non-commercial fuel of 179.41 million tonnes of coal replacement(mtr) was made up of :

fuelwood	116.62 mtr	(65 per cent)
cowdung	26.91 „	(15 per cent)
vegetable wastes	35.88 „	(20 per cent)

The analysis by the Ford Foundation consultants shows the total fuelwood requirement to be 103 million m³ for the year 1970, 13 million m³ from the forests and 90 million m³ from other treelands. As 1 tonne of fuelwood replaces 0.95 tonne of coal, the consumption of 116.62 mtr of fuelwood is equivalent to about 175 million m³. It is thus obvious that 103 million m³ as consumption in 1970 is a low figure, and additional requirement finds a place in the consumption pattern without being accounted for anywhere either by proper reporting or sample studies.

¹ 1974 (May). Draft Report of the Fuel Policy Committee, New Delhi. Department of Mines and Metals, Ministry of Petroleum & Chemicals and Mines & Metals, Government of India.

42.2.10 Fuelwood supply has hitherto been estimated separately from forests and non-forest sources. This classification is in fact not very realistic for statistical purposes. The important factors which affect this calculation are :

- (i) a large quantity of fuelwood is collected from the forests by the local population as a matter of right and does not find any record anywhere;
- (ii) most of the fuelwood being used in the rural sector near the centres of production is collected mainly from the forest nearest to the villages. The people go to the distant forests only when no fuelwood is available nearby; and
- (iii) the pilferages from nearby forests meet a large part of fuelwood requirement in neighbouring areas, and these go unrecorded.

42.2.11 There is a significant amount of multiple use in the rural economy where the same wood is used first as local timber and secondarily as fuelwood. Hence, the classification of fuelwood production from forest and non-forest sources cannot be taken as a rigid one. The total requirement, based on consumption of fuelwood, should therefore be discounted to make a realistic production target for meeting the fuelwood requirement from all sources as a coordinated efforts. By accounting for a reduction of 15-20 per cent from the consumption of about 175 million m³ for 1970-71 — fuelwood as shown in paragraph 42.2.9 — the consumption in 1970-71 works out to about 150 million m³ total and 277 m³ per 1,000 caput.

42.2.12 We do not visualise that there would be any diversion from non-commercial to commercial fuels, so as to make any appreciable effect on the present pattern of fuel consumption. Within the non-commercial fuel sector, however, a deliberate policy should be adopted to reduce consumption of cowdung, so that it is diverted towards use of manure. The percentage of cowdung in the total non-commercial fuel must be brought down from the present 15 to 5 per cent. In view of the expected rise in agricultural productivity, a large part of the diversion can be met by agricultural residues, and possibly a much smaller part of the additional requirement would be demanded from fuelwood sources. Whatever little it is, this plus factor is likely to compensate any diversion from non-commercial to commercial fuels, at least for the next 10 years. We have therefore projected the fuelwood requirement on the basis of 277 m³ per 1,000 caput consumption remaining the same upto 1985. After 1985, the per capita consumption may marginally go down every year, and a fair estimate could be that the per capita consumption would get reduced at the rate of one per cent per annum. The consumption per 1,000 caput in

2000 AD would be about 240 m³. The total requirement of fuelwood, expressed in million m³, would be as follows :

1970	—	150
1975	—	165
1980	—	184
1985	—	202
2000 AD	—	225

Demand for Non-industrial Bamboo

42.2.13 The major industrial use of bamboo is in the pulp and paper industry for which the requirement of the material has been separately calculated under the heading pulp and paper. There is a separate source of consumption in the non-industrial use. The non-industrial uses are really for local domestic consumption and cottage industries for the making of mats and baskets and other assorted goods. A large population has specialised in this traditional cottage industry. Bamboo is also used as the poor man's timber in the construction of huts and temporary dwellings and finds a very wide use in Eastern Uttar Pradesh, Bihar, West Bengal, Assam plains and other States. No systematic studies have been made in this regard. A study of the reported figures of bamboo production from the forests and those used by the organised industry in the pulp and paper sector shows a substantial difference; this difference is apparently used locally and for non-industrial purposes. There is, however, no record of bamboo production from the non-forestry sources such as village sites and individual *baris*. It may be necessary for the Forest Departments either to take to cultivation of bamboo for non-industrial uses, or promote its cultivation by villagers, *panchayats*, etc. Andhra Pradesh has recently proposed to undertake a bamboo project with institutional finance. We, therefore, thought it necessary to give an idea of requirement of non-industrial bamboo in future years, so that it is possible to devise programmes for extension of bamboo cultivation as a part of forest economy. The requirement as worked out by us is given below :

Requirement of Non-Industrial Bamboo

Source	1970		1980		2000	
	(a)	(b)	(a)	(b)	(a)	(b)
from forest sources	2.759	1,490	2.901	1,915	3.361	3,143
from non-forest sources	0.278	150	0.294	194	0.338	316
total	..	1,640	..	2,109	..	3,459

(a) consumption or demand per thousand persons in tonnes.
 (b) total in thousand tonnes.

Supply Possibilities

42.2.14 The requirement of industrial wood in 1970 was about 15.9 million $m^3(r)$, of which about 2.7 million $m^3(r)$ was of softwood and 13.2 of hardwood. The estimate of recorded production of industrial wood was only 8.92 million $m^3(r)$, comprising the hardwood production of 7.63 million $m^3(r)$ and 1.29 of softwood. There was a large gap between the requirement and supply. In the matter of fuelwood supplies, the recorded production was only 13 million m^3 , while the total consumption was estimated to be about 175 million m^3 . In the case of industrial wood, the difference is accounted for by supply from farm lands and from unrecorded sources. Regarding fuelwood, difference is mainly accounted for as unrecorded production. It is assumed that the bulk of unrecorded production comes from treelands and farms, but in actual fact this may also include substantial pilferages from the forests. The total requirement of industrial wood would rise to about 25 to 27 million $m^3(r)$ in 1980, 30 to 35 in 1985 and 47 to 64 in 2000 AD. For entering the export market more vigorously from 1985 onwards in respect of sawnwood and plywood and veneer, additional industrial wood requirement would be as follows :

1985 — 3.0 to 3.7 million $m^3(r)$

2000 AD — 4.8 to 6.6 million $m^3(r)$

Similarly fuelwood demand would also rise quite substantially. An effort is made in the next few paragraphs to examine the possibilities of supply from different sources, so that a viable programme can be drawn up for the productive uses of forests.

42.2.15 The demand of industrial wood and fuelwood would be met by :

- (i) Man-made forestry programme;
- (ii) concentrated natural regeneration programmes;
- (iii) working of inaccessible coniferous and hardwood forests by infrastructural development;
- (iv) thinnings and final fellings of existing plantations; and
- (v) social forestry.

In our Interim Report on Production Forestry — Man-made Forests, we have given a set of statements* to show how with proper investments in logging and plantation, it is possible to meet the domestic wood requirement.

* Statements 4.2 and 5.2 in Appendix IV.

42.2.16 Till the turn of the century, a large part of the industrial wood supply would come from the existing forests. In order to produce the diverse categories of industrial wood, about 55 per cent of the area felled is expected to be regenerated naturally and the balance by planting, bearing in mind the biological characteristics of the main species involved. Pulpwood can be produced from plantations on short rotations, say 10-20 years for hardwood and 30-40 years for tropical pines. For other kinds of timber, such as saw logs or veneer logs, the average rotation could be 60 years. There are 4.2 million ha of coniferous forests in Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir. About one-third of the gross area may be unavailable for industrial wood production for reasons of protection, high altitude, etc. There would thus be about 2.7 million ha of coniferous forests available for industrial wood production. We have calculated the possible outturn on the basis of studies made by Singh¹ and PIS² on spruce-fir forests and *chir*-blue pine-*deodar* forests respectively. Assuming that some yield would be available from thinnings, 8-9 million m³ of coniferous wood may be extracted in 2000 AD. This would meet more or less the 'low' demand for domestic consumption and export. To meet the 'high' domestic demand and export target, additional 4-5 million m³ would have to be made available from final fellings, including the man-made forests. Considering the yield expected from tropical pine plantations, an annual area of about 20,000 ha would have to be brought under such plantations by 1980 at the latest.

42.2.17 As regards hardwood, it is seen from some of the project reports for intensive development of forests prepared recently that the stocking in hardwood forests of medium density is 80-90 m³(r)/ha. The forests in the Eastern Himalayas or Andaman & Nicobar Islands, however, have a growing stock of more than 200 m³(r)/ha, but many of the species are not in commercial demand. Research would improve the position, but considering that low quality forests would also have to be brought under the programme of clearfelling and planting under production and social forestry and also considering that a part of the total available wood would be suitable as fuelwood only, it would be safe to assume an average yield of 60 m³(r)/ha of industrial wood from the hardwood forests. Considerable quantities of pulpwood and roundwood particularly would also have to be made available from short rotation plantations. Keeping in view the magnitude of administrative and technical effort needed and the average rotation for conver-

¹ Singh, R. V., 1975. Management of Pir Forests Through the Century, Ind. For., 100(1).

² 1970. PIS—Forest Resources Survey: pp 74-75, Tables 26, 27. Rome, UNDP—FAO.

sion of the existing forests into even-aged ones, the regeneration operation in 2000 AD can be visualised as follows :

Annual area (ha)	Average rotation (year)	Purpose	Total area required (million ha)
man-made forestry :			
20,000	35	coniferous pulpwood (tropical pines)	0.7
160,000	15	hardwood pulpwood	2.4
200,000	60	saw logs, veneer logs, etc.	12.0
natural regeneration :			
30,000	90	coniferous wood	2.7
400,000	75	hardwood	30.0
total			47.8

It is, therefore, necessary that an extent of about 48 million ha, including 2.7 million ha of coniferous forests, should be identified immediately for being dedicated as production forests in use. It is seen that concentrated regeneration over about 0.8 million ha, if necessitated by demand, should be taken up by 2000 AD, as against the estimated level of 0.3 million ha in 1973-74. However, the annual production of hardwood is expected to be of the order of 34-35 million m³(r) in 2000 AD from artificial and natural regeneration areas, and another 10 million m³(r) from short rotation plantations. This quantity would be sufficient to meet the 'low' demand for domestic consumption and export. To meet the 'high' domestic demand and the export target as well, another 10-12 million m³(r) of industrial wood would be necessary. This quantity must be met from social forestry programme. As regards production of bamboo, we are of the view that if removal of bamboo is done strictly according to the silvicultural methods and if the natural and artificial regeneration of bamboo is encouraged in the areas where bamboo grows gregariously, the yield per hectare would improve considerably. Hence, there should be no difficulty in meeting the projected requirement of bamboo.

42.2.18 The regeneration operations are expected to increase from the present level of about 3 lakh ha to about 6 lakh ha by 1985 and then further to about 8 lakh ha by 2000 AD. Considering that about Rs. 500 per ha may be needed for natural regeneration and Rs. 1,200 per ha for man-made forestry, the average annual requirement till 1985 would work out to about Rs. 35-36 crores. In addition, there should be sufficient allocation of funds for social forestry. The logging cost is not included.

42.2.19 In order to indicate the magnitude of the task involved and the regions which require priority attention, we have calculated the average annual removal of wood (industrial wood and fuelwood) for the period 1965-66 to 1969-70 based on the available statistics¹. It is found to be $0.31 \text{ m}^3(\text{r})/\text{ha}/\text{yr}$ from the gross forest area. Of this, 0.13 constitute industrial wood and 0.18 fuelwood. We have classified the States according to the wood removal, and shown the position in Appendix 42.4. The lowest class, containing removal from $0-0.20 \text{ m}^3(\text{r})/\text{ha}/\text{yr}$, comprised about 33 per cent of the total forest area. The average class of $0.21-0.40 \text{ m}^3(\text{r})/\text{ha}/\text{yr}$ constituted about 45 per cent of the area, while about 9 per cent and 13 per cent of the area fell in the classes of $0.41-0.60$ and 0.61 and above respectively.

42.2.20 Appendix 42.4 also shows the per capita forest area in the States as in 1969-70. It is seen that the per capita forest area has hardly any relation to the intensity of forest working. For instance, Orissa and Jammu & Kashmir have comparatively high per capita forest areas, namely 0.31 and 0.46 ha respectively. But the actual removal of wood is only 0.17 and 0.21 respectively. On the other hand, Kerala and Uttar Pradesh have only 0.06 ha/caput forest area, but the removal of wood is $1.11 \text{ m}^3(\text{r})/\text{ha}/\text{yr}$ for Kerala and 0.94 for Uttar Pradesh — three times or more compared to the average for India. Inaccessibility has been one of the causes no doubt, but the inaccessibility has been the result more of lack of investment than any intrinsic topographical conditions. If the requirement of industrial wood as projected in 1980, 1985 and 2000 AD has to be met, the removal of industrial wood alone would have to be stepped up to $0.33-0.36 \text{ m}^3(\text{r})/\text{ha}/\text{yr}$ in 1980, $0.44-0.52$ in 1985 and $0.69-0.95$ in 2000 AD from the level of 0.13 in 1970, corresponding to 'low' and 'high' demands.

42.2.21 Technically it should not be a difficult task to obtain industrial wood removal of this magnitude, when it has been possible to reach a very high mean annual increment (MAI) in the plantation crops. For instance, *dhupi* (*Cryptomeria japonica* D. Don) plantations in the Darjeeling hills in West Bengal have attained an MAI of $25 \text{ m}^3(\text{r})/\text{ha}$ in 25 years. In the Bastar region of Madhya Pradesh, the following MAI is expected to be attained: *chir* (*Pinus roxburghii* Sargent) — $6.5 \text{ m}^3(\text{r})/\text{ha}$, *sal* (*Shorea robusta* Gaertn.f.) — $7.5 \text{ m}^3(\text{r})/\text{ha}$ and teak (*Tectona grandis* Linn.f.) — $5.6 \text{ m}^3(\text{r})/\text{ha}$. Even with the present scale of intensive management, Kerala and Uttar Pradesh have already achieved removal rates of 0.67 and $0.33 \text{ m}^3(\text{r})/\text{ha}/\text{yr}$ respectively in

¹ 1972 (February). Forest Statistics Bulletin No. 13—Removal of Wood and Bamboo., New Delhi, Central Forestry Commission, Ministry of Agriculture, Government of India.

respect of industrial wood alone, calculated on the gross forest area. It is possible to achieve higher rates of removal by opening up inaccessible forests.

42.2.22 Taking the case of Madhya Pradesh, a State falling in the average class with respect to wood removal, it is found that the timber and fuelwood removal at present is 0.16 and 0.13 m³(r)/ha/yr respectively. The Bastar Project¹ alone would add about 0.14 m³(r)/ha/yr to the wood removal in the State and almost the whole of it may be used as industrial wood, as pulpwood and fuelwood are interchangeable. Taking the case of Maharashtra, which falls in the above-average class, the present wood removal calculated on the gross forest area of the State is : timber 0.07 and fuelwood 0.36 m³(r)/ha/yr. The Intensive Forestry Project of Eastern Maharashtra² is expected to add immediately a further quantity of 0.24 m³(r)/ha/yr to the total wood removal. If no constraint is put on the setting up of the forest based industries, almost the entire wood can be utilised as industrial wood. In the case of West Bengal, which falls in the highest class but has practically the least per capita forest area; the present rate of removal is : timber 0.20 and fuelwood 0.66 m³(r)/ha/yr. A project prepared for the intensive development of the inaccessible forests in the Darjeeling hills shows that it is economically viable and the project covering 1,500 sq km only would further add in three to four years 0.35 m³(r)/ha/yr (timber 0.17 and pulpwood/fuelwood 0.18) to the total wood removal in the State.

42.2.23 Regarding fuelwood, the requirement by 2000 AD has been projected by us to be 225 million m³(r). It may not be possible to obtain more than 60-70 million m³ as by-products of production forestry in the form of lops and tops or residues of forest based industries. In the rural economy, woody and shrubby growths on uncultivable wastelands, fallows or in the villages or on the bunds of agricultural fields would continue to be used as fuel. The balance requirement of fuelwood in the rural areas must be met through a dynamic programme of social forestry. The transportation of fuelwood to urban areas should be discouraged in the long run, and the entire requirement of the urban areas met from commercial fuels. The extension organisation in the Forest Departments that we visualise for the implementation of the programme of social forestry should be in a position to collect dependable statistics of the fuelwood production obtained through the programme of social forestry.

¹ 1973 (September). Formulation and Economic Assessment of an Intensive Forestry Project for the Bastar Region of Madhya Pradesh. Madhya Pradesh Forest Department—Ford Foundation—Planning Commission.

² 1973 (September). Formulation and Economic Assessment of an Intensive Forestry Project in Eastern Maharashtra. Maharashtra Forest Department—Ford Foundation—Planning Commission.

3 THE INTERIM REPORT ON PRODUCTION FORESTRY

42.3.1 We are convinced that forestry must come out of the rut of low-investment low-yield practices, in the face of mounting demands for forest products and in view of the need for achieving self-sufficiency and for creating more employment opportunities in the rural areas. We are of the view that a new commercial approach to forestry development has to be built up. The development in the forestry sector so far has been hindered due to paucity of funds and the institutional system under which the development programmes are being financed. It is in this context that we submitted the Interim Report on Production Forestry — Man-made Forests* in August, 1972. The objectives we have defined for production forestry are as follows:

- (i) to raise the per hectare production both in respect of volume and value;
- (ii) to create much more employment for skilled as well as unskilled hands;
- (iii) to give a substantial support to the economy of the backward areas and the tribal population which depends for growth on forestry activities;
- (iv) to expand or establish a large number of industries based on raw material from the forests;
- (v) to enter the export market in wood and wood products; and
- (vi) to have a sustaining impact on the employment in the secondary and tertiary sectors.

Relevance of Man-made Forests

42.3.2 The experience of other countries shows that forestry can give higher return per ha, provided it is possible to adopt intensive management including creation of man-made forests on a far larger scale than has hitherto been possible in India for lack of adequate investment. Limitation of usable land, coupled with ever increasing demand for forest based products, makes it imperative that maximisation of return per ha of forest lands has to be attempted. It is necessary to go in for balanced inputs at high cost as against traditional practices with low cost inputs.

42.3.3 We pointed out in the Interim Report the importance of man-made forestry in view of the mounting demand in the country for newsprint, paper and for packing material as well as for other products both for exports and substitution of imports. The important

* Henceforth referred to as Interim Report in this section.

developments had been noted by us, namely pulpwood plantations on a short rotation basis and use of mixed hardwoods in increasing proportion in the pulp for paper making. These developments have started giving an economic value to the pulpwood. The increasing demand for packing material has also led to the utilisation of such classes of trees as had formerly no market. Moreover fuelwood demand and prices have gone up to such an extent that an economic return on fuelwood is possible even when clearfelling has to be resorted to at a reasonable distance from consuming centres.

Integration between Forest and Forest Industries

42.3.4 We have emphasised that production forestry is a business and it must therefore be closely linked with marketing and utilisation. A forest production programme in isolation will not succeed. The requirement of specific industries should be a major reason for initiating forestry activities, which means a close link between the two. An adequate capacity in the forest based industries should be planned in such a way that the utilisation of the produce from man-made forestry programmes is synchronised with a specific industry which is to go on stream in future. From the economic standpoint also there is a strong justification for bringing about a close link between the resource development and utilisation. The profitability of any plantation project when it is considered in isolation is quite different from when it is linked with utilisation. This is so because in the latter case the profitability is an integrated one.

Inadequate Institutional Arrangements and Finance

42.3.5 We stated that the existing institutional arrangements had stood in the way of the forestry sector playing its rightful role in the national economy. The rigid adherence to prevailing rules and procedure which is imperative under existing forest administration does not permit the management of forests as a commercial enterprise and the fulfilment of its proper role in the economic life of the country. In the Interim Report we made reference to the inadequate investments. Uncertainties of budget allocation had also, to a considerable extent, impeded the growth of the forestry sector. It so happens that in the overall considerations for development in the States, the schemes of forest development do not find adequate priorities. An example was given about the fast growing species schemes which originally started as a Centrally sponsored scheme to bridge the gap between demand and supply of industrial wood. After the scheme was transferred to

the State sector it suffered considerably owing to the inadequate financial provision in the State sector.

Benefits from a Man-made Forestry Programme

42.3.6 The most important desirable characteristics of forests for economic wood production in the future would be :

- (i) suitability of the wood produced for the end purposes proposed;
- (ii) large volumes per unit areas;
- (iii) homogeneity of materials; and
- (iv) accessibility in relation to markets.

Much of India's forests are lacking in these characteristics

42.3.7 By correct choice of site and species it may be possible to create man-made forests on sites which are both capable of producing satisfactory rate of growth and readily accessible to markets. Apart from the monetary benefits, these plantation forests have also the advantage of suitability and homogeneity of end product, high growth rates and short rotations. By correct choice of species much more rapid growth rates can be achieved than in natural forests. Consequently for a given yield man-made forests need considerably smaller areas than natural forests. However, man-made forests have their problems, viz. selection of species with reference to site, quality of seed, difficulties in seed procurement, risks of diseases and insect attack, improvement of techniques, long term effect on soil and productivity, etc.

42.3.8 A change over to intensive man-made forestry will, however, bestow the following advantages :

- (i) immediate increase in timber and pulpwood availability for meeting the present demand;
- (ii) creating incentive for increasing installed capacity of industries consuming forest produce thereby providing additional employment in secondary and tertiary sectors;
- (iii) planning future production of pulpwood according to market preferences, both internal and international, and reduction of wasteful growth;
- (iv) built-in soil conservation programme;
- (v) large scale additional labour employment opportunities in both skilled and unskilled categories in the primary sector; and
- (vi) increased and planned recreational facilities.

A Few Recommendations Discussed

42.3.9 It had been shown in the Interim Report that sufficient extent of production forests are available for taking up an aggressive man-made forestry programme, and it was recommended that future production programmes should concentrate on clearfelling of inaccessible hardwood forests, followed by that of mixed quality forests and valuable forests, and planting with suitable fast growing species yielding higher return per unit area. The resulting produce from the clearfelled areas should be utilised in wood based industries as far as possible.

42.3.10 We had recommended that the agency to implement the man-made forestry programme and the supporting forest industries in the States should be organised in the public sector as a fully owned State company or a corporation. Each State might have one or more corporations according to the size of the programme and the location of the forests under the programme. Such of the corporations that take up supporting paper and pulp industry could either set up the industry as a subsidiary of the corporation or form separate companies. The areas selected and considered fit for commercial production should be transferred by the State Governments to these corporations.

42.3.11 While formulating intensive forestry projects for corporations, it was found that in some cases (e.g. Eastern Maharashtra and Bastar) the net income from the clearfelling operations that precedes the man-made forests was high in view of the potential valuable nature of the existing crop. The benefit that entered into the project stream was open to question in the minds of some foresters. This question of the legitimacy of imputing the net income as a project benefit has been considered, and we are of the view that the procedure adopted is justified. In this connection we quote below the view of the Ford Foundation consultant in India so far as it relates to the project for Eastern Maharashtra; it has relevance to the formulation of future projects in other States too¹.

"The first operation, clear-cutting fetches an income. This benefit must be attributed to the project for a very simple reason; it materializes because of the project, and would not occur without it. Naturally, there is a cost to it; the income foregone from the original growing stock. Fortunately for the project economics, this cost is very low. By and large, the forests are either over mature, poorly stocked, or both. This fact, reflected in a negligible net annual growth is further aggravated by the high exploitation

¹ 1973. (October). Letters to the Editor, Ind. For., Vol. 99(10).

costs resulting from the disperse selective cutting operations hitherto prevalent.

"In other words, without the project these forests would carry on the languid low (physical and economic) productivity regime of today. With the project they are to be replaced, with a small cost, by high yielding plantations....."

"In terms of the standard benefit-cost parameters, a situation like the one prevalent in East Maharashtra should put the project high in the economic ranking. And this is only a natural consequence of the very favourable (and relatively new) market possibilities that most forest products find in India today....."

42.3.12 We had recommended that the forest land and its standing timber transferred to the corporation would be valued and these two values together would form the basis of equity capital against which it could borrow from institutions. Where these values are not adequate to generate sufficient funds in time for the industrialisation programmes, the State Governments may have to subscribe additional equity funds to the corporations from their planned resources. In presenting models for converting mixed forests stands into man-made forests and for industrial development programmes, we recommended generally a debt-equity ratio of 2 : 1 and 2.6 : 1 respectively. This was only as a way of illustration and should not be construed as binding.

42.3.13 We discussed the question of Agricultural Refinance and Development Corporation (ARC) as the lending agency for the plantation operations. We recommended that the Statute of the ARC should be amended to allow direct long term financing to the State forest corporations, instead of channelising it through a commercial bank, as the latter practice would be pushing up the ultimate interest rate. We also recommended that in case this was not possible, a Central forest credit corporation should be organised to take up the responsibility for providing long term finance for the plantation and development programme, though we have viewed the modifications of the Statute of the ARC to be the best solution. For the industrial programme based on forest raw material, we recommended financing through long term industrial lending institutions like the Industrial Development Bank of India, Industrial Credit and Investment Corporation of India and the Industrial Finance Corporation of India.

42.3.14 We also stated in the Interim Report that the composition of the crop to be raised and mixture to be adopted would require proper planning and a thorough study of their growth rates under improved techniques. The massive programme of conversion and creation of man-made forests would require careful selection of the species to be raised, their mixture to be followed and estimates of production.

A knowledge of end use for wood based industries, of course, is necessary for proper planning. While different species might be primarily earmarked for different consuming industries, selection of some species with multiple demand would be an important consideration. It may be safe to plan production of pulpwood, for instance, for the domestic market. But additional production should preferably come from species which have got other utilities to fall back upon, in case the pulp and paper market does not grow to the present expectation. We had also stated that while planning for afforestation each State should carry out these exercises and evolve its own strategy with regard to the proportion of species and areas to be devoted to different kinds of produce keeping in view national requirement.

42.3.15 Establishment of man-made forests requires investment of capital over long periods. So the decision on rotation should be taken on the basis of economic criteria. One of the main difficulties in determining optimum rotation would be lack of accurate data on costs and reliable price gradients for the products. We opined that if the rotations are based on economic criteria there would be considerable scope in reducing both pulpwood and timber crop rotations. The future change in technology would also encourage such shortening of rotation. Mechanised felling including uprooting of stumps creates facilities for inter-cropping between lines of planting for production of agricultural and horticultural crops.

42.3.16 There must be an incentive for a change-over from the low-cost low-yield forestry to a commercial high investment economic forestry. Accordingly, we recommended that the price for the produce should be so fixed as to pay for the cost of clearfelling and plantations, and leave a profit. There has to be a rational pricing policy in future for bamboo and pulpwood, which are the two main raw materials required for paper and pulp making. The paper industry should be in a position to pay higher royalty if uniformity of raw material is assured through plantations. The industry could pay still higher prices, if the plantations are within a reasonable distance from the factory. It should be possible for both the forester and the industry to take a reasonable view in this matter and plan the programme of man-made forests to make it a profitable venture.

42.3.17 It may be pointed out that though the Interim Report dealt with man-made forestry, it will not be the only component of production forestry. In Section 2 of this chapter, we have indicated that a forest area of about 48 million ha should be identified for production forestry. Only a part of that area would be covered by the man-made forestry programme, because natural regeneration of indi-

genous species would also be a viable production forestry programme in many areas.

42.3.18 Before concluding this section, it may be mentioned that there is a suggestion that forest lands may be leased out to the pulp and paper industry for raising plantations to meet their own industrial wood requirement. We have considered the suggestion carefully. Forest lands are utilised for multiple purposes. It is not only the industrial wood but also fuelwood, small timber, controlled grazing facilities, minor forest produce, etc., which are obtained from the same forest area and are utilised in the best possible national interest. Moreover, the policy of the Government is to take over all forest lands in the country under State management, and the process of taking over of private forests had started from the late fifties. The Central Board of Forestry in its Twelfth Meeting held in May, 1970 considered the question of providing facilities for undertaking plantations of fast growing species by the paper mills. It is decided that the agency which will create and tend the plantations will be the Forest Department of the State/Union Territory concerned. We are also of the opinion that forest lands should not be leased to the forest based industries for raising plantations. The produce, however, should be allocated to different industries at an economic price, in order that a commercial high investment economic forestry can be introduced in the manner recommended in the Interim Report.

4 EXPORT POTENTIAL OF INDIAN TIMBERS AND PROCESSED PRODUCTS

42.4.1 Demands for timber and processed wood products appear to be steadily mounting and are going ahead of indigenous supply in developed countries. But the part taken by this country in export has been limited so far to a few traditional items in a restricted quantity. These items have a high value even in the domestic market. No concerted efforts were made to organise a proper export drive mainly due to the wrong impression that this country was short of forest raw material for its own requirements. Data of the type required to organise export of wood and wood products were virtually uncollected. It would be necessary, and feasible too, for this country to enter the world timber market and to create a market, to begin with, for the species well known in the trade so far. Consistent market intelligence studies for the type and quality of produce required abroad would have to be organised. An active organisation to coordinate efforts at home to process the intelligence and effective research and statistical programme to assimilate the peculiarities of trade in the importing

countries would have to be built up. These issues have been discussed in this section with reference to timber (round and sawn), panel products and shaped wood products.

Current Situation

42.4.2 For a long time, minor forest products held sway in the total export of forest products. However, export of major forest products started going up from 1966-67, though 1971-72 was again a somewhat disappointing year for export of major forest produce. While in 1965-66, the major forest products contributed only about 21 per cent of the total export trade of forest products in 1973-74 the proportion rose to about 45 per cent. The share of major forest produce dropped sharply to about 30 per cent in 1974-75, partly because of substantially lower export of wood in the round or roughly squared and partly because of considerably higher export of some items of minor forest produce like lac and its products, plants, seeds, etc. used in perfumery and pharmacy, and essential oils. However, timber in the round (logs or roughly squared) contributed about 50.7 per cent of the total foreign trade in major forest produce in the triennium 1972-73 to 1974-75. Out of this, rosewood was the largest contributor. The share of major and minor forest produce in the export trade from 1965-66 to 1974-75 is given in Table 42.2. In Appendix 42.5, we have given the details of different components in the export trade of major forest produce in terms of value and an average for the triennium 1972-73 to 1974-75.

Problems in Export Trade

42.4.3 An analysis of the species exported exhibits a very disappointing feature. It is seen that mainly three or four hardwood species are being exported, though the demand for other Indian hardwood species can also be created. Dependence for export has been almost solely on rosewood (*Dalbergia latifolia* Roxb.), followed by sandalwood (*Santalum album* Linn.) and red sanders (*Pterocarpus santalinus* Linn. f.). There has been increasing export of *sal* from 1971-72 to 1973-74, but in 1974-75 it went down sharply. The export of teak had been steadily going down, but in 1974-75 it had come up considerably. Among the other hardwoods exported in very small quantities are those from tropical evergreen forests of the Andamans, Assam and other parts of Eastern India, such as *gurjan* (*Dipterocarpus* spp), *hollong* (*D. macrocarpus* Vesque), *hollock* (*Terminalia myriocarpa* Heurck & Muell.—Arg.) *badam* (*T. bialata* Roxb.) Steud. ex Kurz),

white *chuglam* (*T. procera* Roxb.), *padauk* (*Pterocarpus dalbergioides* Roxb.), *siris* (*Albizia* spp), etc.

TABLE 42.2

Share of Major and Minor Forest produce in the Export Trade of Forest Products¹

(value Rs. in crores)

Year	Share of major forest produce		Share of minor forest produce		Total value of export
	Total value	Percentage	Total value	percentage	
1965-66	3.28	21.3	12.11	78.7	15.39
1966-67	5.38	29.0	13.18	71.0	18.56
1967-68	7.52	36.9	12.92	63.2	20.44
1968-69	12.48	47.4	13.82	52.6	26.30
1969-70	13.29	41.1	19.03	58.9	32.32
1970-71	14.13	20.0	21.15	60.0	35.28
1971-72	11.37	32.3	23.79	67.7	35.16
1972-73	15.09	40.6	22.06	59.4	37.15
1973-74	29.31	44.7	37.03	55.3	66.34
1974-75	25.25	29.5	60.47	70.5	85.72

42.4.4 Though the virgin forests of the Andaman & Nicobar Islands offer the prospect of a large volume of tropical hardwood suitable for export, the main problem encountered is the cost of shipping. We have dealt with the special problems of the Andamans in Section 13 of this chapter. There is also the problem of making a selection of species or groups of species for export purposes and to locate the areas of supply. Introduction of new species in the export market, which India will also have to do, will raise the following problems:

- (i) novelties tend to be looked on with suspicion;
- (ii) new species have to be introduced by an importer who is known and assurances of previous successful experience with the species in question must be forthcoming; and
- (iii) once a species is launched, it is essential that continuity of delivery should be guaranteed.

¹ Data for the years 1965-66 to 1968-69 pertain to the items listed in Appendix III of "Foreign Trade of Forest Products" (Bulletin No. 6, January 1971) issued by the Central Forestry Commission, Ministry of Agriculture, Government of India, and for the later years include essential oils also.

This will require a proper organisation not only to undertake an export campaign to promote trade in tropical sawnwood but also to ensure strict quality control. Such an organisation is non-existent in this country.

42.4.5 The present export policy with regard to timber is to list the species together with the quantity for each allowed to be exported. Quota for different ports for each species are also given. Generally red sanders and sandalwood are licensed freely on merits for export. Walnut wood, other that burns and stumps, roots and logs containing root or any part thereof, is allowed to be exported on merit in consultation with the Ministry of Agriculture & Irrigation. For most of the other species, quotas are fixed. The policy is inadequate to meet any aggressive effort for export, because even if quota for a particular port remains unutilised, there would be considerable delay in utilising the shortfall in any other port. Moreover, adequate quantity of one species or a group of species with similar characteristics would have to be ensured to the importers and as such small quota for different ports would not meet the situation.

Timber

42.4.6 In Appendix 42.6, Statements I to V, we have given the figures for regionwise export of the timber mostly in the round. The traditional markets for round timber should be converted into markets for sawn timber. Japan and Western Europe offer promise in this respect. The objective can be achieved partly by lowering roundwood export (export earnings would not be affected because sawnwood will have higher value) and partly by vigorous export promotion. It is found that most of the species which constitute about 90 per cent of timber import into Western Europe are moderately durable to very durable. But even non-durable species like *ramin* (*Gonystylus* sp) and *obeche* (*Triplochiton scleroxylon* K. Schum.) have a fair share. In Appendix 42.7 we have mentioned for vigorous export promotion. Timber having an average life of 10 years or more is considered as of high durability and between 5 to 10 years as moderate as per practice in vogue in India. Trade names for export purposes should be standardised, because the same species is known under varying local names in India. We suggest that the Forest Research Institute (FRI), Dehra Dun should immediately take up preparation of publicity material, pointing out the characteristics and uses of each species and its equivalence with those already in demand in the export market. Apart from the hardwood listed, we anticipate that export prices of pines

will be remunerative enough for the Himalayan pines to attain a competitive edge. It is understood that spruce and fir from Jammu & Kashmir are already finding a market in West Asia.

42.4.7 A study by General Agreement on Trade and Tariffs (GATT) — International Trade Centre¹ covered seven countries, namely United Kingdom, West Germany, France, Netherlands, Belgium, Luxemburg and Italy. It was found that these seven countries imported 1 million m³ of tropical sawnwood in 1965, with a c.i.f. value of US \$ 87.2 million or about Rs. 65 crores. Fifty per cent of the import came from two countries: Malaysia and the Ivory Coast. Other suppliers were Ghana, Nigeria, Congo, Zaire, Cameroun, Mozambique, Burma, Thailand, Indonesia, Guyana and Brazil. The study has projected that in 10 years from 1965 to 1975 the demand for tropical sawnwood in Western Europe would rise by 127 per cent.

42.4.8 Regarding Japan, it is seen from a study in 1969-70 by the Toulumne Corporation, San Francisco that 6.9 million m³(r) of its 1969 consumption came from the South Seas (comprising Phillippines, Malaysia, Indonesia and Solomon Islands, Papua-New Guynea and Combadia). The consumption is expected to go up to 21.1 million m³(r) in 1975 and 23.4 in 1985. Although most of Japan's sawnwood imports have entered in the round form, imports in sawn form are on the increase and the economic conditions of the log trade and the sawmilling industry in Japan indicate that sawnwood would offer the most opportunity for increased product export.

42.4.9 The prospects of diversion of home grown sawnwood for export should be studied in depth. An example of teak sawnwood for export may be given. A study² in 1970 indicated that export of teak sawnwood can be increased to 20,000 m³ by 1975 and 30,000 m³ by 1980, which would be only 9 and 12 per cent respectively of the total production of teak. In 1974-75, India's export of teak was only 4,500 m³. In the previous year, it was only about 860 m³. The main reasons why the export performance of teak is so unsatisfactory are: (a) quota system, often of very small quantities, for different ports, (b) high domestic price even for sub-standard qualities, leaving no incentive for export and (c) lack of organised export promotion. We suggest that with a view to earning foreign exchange, export of well known species that are in demand in the export market should be allowed liberally, and the use of other available hardwood species as substitutes popularised

¹ 1967. Major Markets for Tropical Sawnwood in Western Europe, Geneva, GATT-IIC.

² 1970 (February). Survey of India's Export Potential of Wood and Wood Products. Vol. IV : p 123. New Delhi. The Marketing Research Corporation of India.

in the domestic market. It may be mentioned that the Marketing Research Corporation of India also suggested the imposition of a severe excise duty on teak sawnwood so as to restrict domestic consumption. We agree with the recommendation.

42.4.10 We recommend that the export of roundwood, particularly of species suitable for high grade veneering, should be progressively discouraged and that of processed sawnwood and panel products encouraged. Phillippines have recently issued orders banning export of roundwood by 1976. We have dealt with the export of panel products later, but we would like to mention here that in order to switch over to the export trade in sawnwood from roundwood, it would require improvement in the quality of sawing in India, so as to satisfy the exacting demand of the trade in Europe and Japan. In our least capital-intensive sawmilling industry, the machinery used is quite 'elementary' and precision sawing is out of the question. Almost all the sawmills in India use only 5 to 7.5 cm wide bandsaws for breakdown purpose with a crude form of trolley, and the setting for the width of the cut is also rather crudely manipulated. For re-sawing, tape saws of 2.5 to 3.75 cm width are invariably depended on. Saw-doctoring is only in a primitive stage. In any case, saw-doctoring as a profession cannot come into its own, unless export-oriented sawmills are established. It should, therefore, be necessary to locate the areas of abundant availability of timber for establishing sawmills and other industries for export purposes. In such sawmills precision machinery should be installed, so that it is possible to produce sawn timber with the requisite tolerance limits. The importers in the developed countries are generally interested in purchasing kiln-dried sawn timber. So this is another side of the technology that must be integrated with sawmilling. A professional course for saw-doctoring as introduced in one of the training centres of the Logging Training Centres Project would not suffice. In addition there should be a team of experts, who should go round the export-oriented sawmills (or even comparatively bigger sawmills for home consumption), and hold practical training session for 2-3 months at each place. The State forest development corporations should take a lead in this matter.

42.4.11 There should be a strict adherence to grading. In Europe all importers accept Malaysian grading rules as satisfactory and in the standard contract forms there are clauses to bind both parties to follow these rules. It will be necessary for India to compare Indian specifications with accepted grading rules, as otherwise difficulties might be faced when initial steps are taken to enter vigorously into the export

market. There should, therefore, be a regulatory organisation in India to be a watch-dog regarding quality of sawing, grading and standardisation. In the Netherlands, which is a big importer, the Dutch Hardwood Association is a very effective and agile watch-dog in the standardisation of hardwoods. The Indian regulatory organisation could work in close cooperation with the Dutch Hardwood Association. It would also be useful to associate this country with the various technical and other studies being carried out by the Economic and Social Commission for Asia and the Pacific (ESCAP) in regard to timber exporting countries of Asia and the Pacific.

42.4.12 The entrepreneurs, be they in the public or private sector, will also have to rise to the need of diversifying products or switch over to other products in the light of intelligence received and research carried out. For instance, at present in Europe, the tropical sawnwood appears to be in greater demand for use in parquet flooring. So the possibilities of export of wood in the form of non-assembled strips and mouldings will be worth studying thoroughly. As regards export of furniture, there are good prospects for export in knock-down form. It should be the duty of the State forest development corporations to find out markets and designs for such type of furniture and to promote their exports. The corporations will have also to realise the promise in export market for certain articles of wood, such as beading and moulding strips, children's toys, 'do-it-yourself' outfits, etc.

42.4.13 In Fig. 42.1, we have represented the pattern of India's trading partners in the export field for timber for the last 6 years or so. It is seen that comparatively higher value per unit is obtained from Western Europe than from Japan. But the trade almost solely consists of rosewood, sandalwood and teak to Japan and rosewood to Western Europe. North America (USA and Canada) also imports a small quantity of rosewood from India. The trade with West Asia has almost solely been with paliwood (*Palaquium ellipticum* (Dalz.) Bailon). There should be promotional efforts for marketing other woods. The installed capacity in the sawmilling industry should be such that over and above meeting the domestic needs completely by 1985, there is enough surplus capacity for export. We recommend that the installed capacity for production for export should be about 15 per cent higher than that required for meeting domestic demand.

Panel Products

42.4.14 The export of plywood and veneer constituted about 19 per cent of the total foreign trade in major forest produce of this country in the triennium 1972-73 to 1974-75 in terms of value. The

FIG. 42.1

(PARAGRAPH 42.4.13)

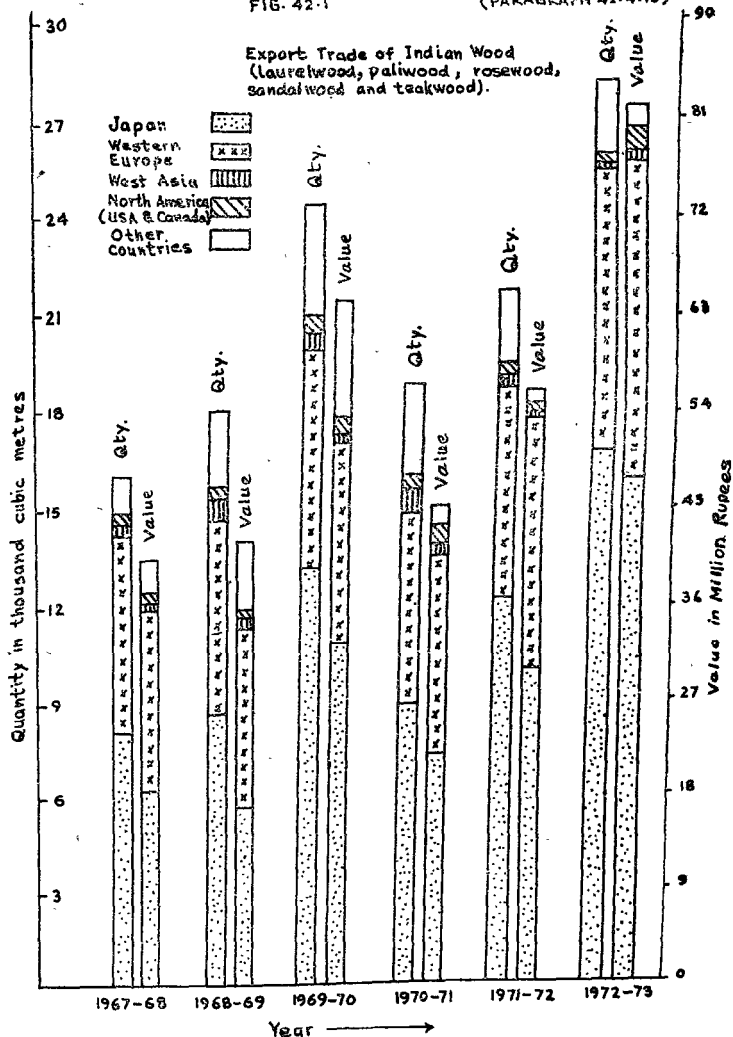
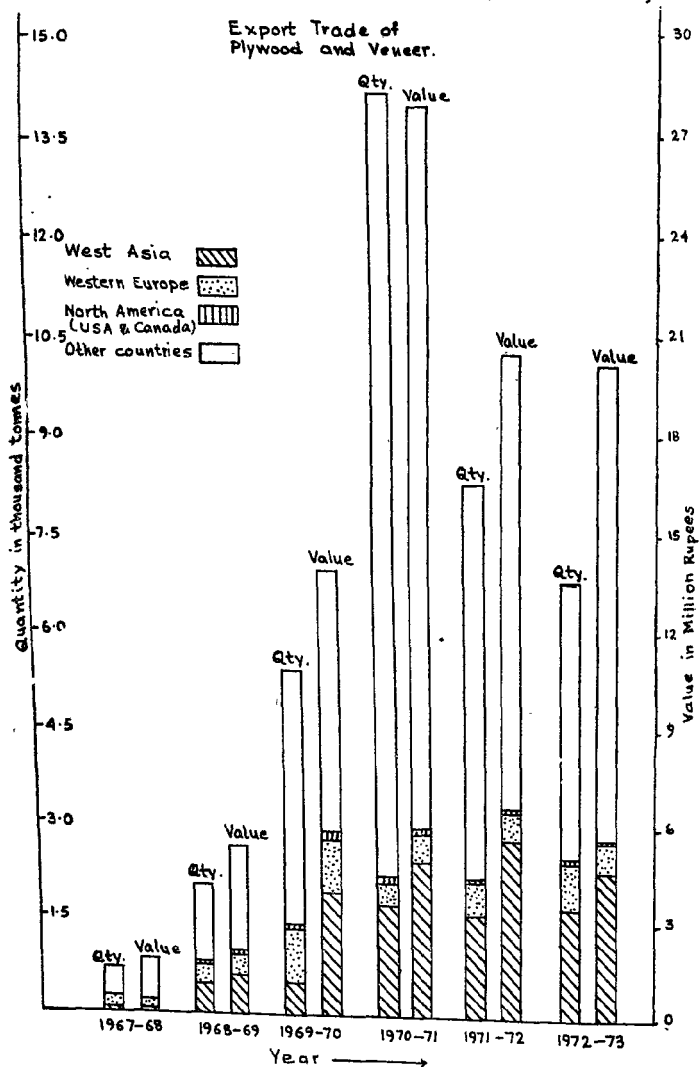


FIG. 42.2

(PARAGRAPH 42.4.14)



export of panel products, however, reached a peak in 1970-71 with a quantity of 7134 tonnes valued at about Rs. 1.42 crores. But in 1972-73, the export came down to 3,744 tonnes valued at about Rs. 1.10 crores. It is seen from the recent statistics quoted below that export position has substantially improved in recent years :

	Quantity (tonne)	Value (Rs. crores)
1973-74	15,791	4.57
1974-75	20,364	7.38

Fig. 42.2, regarding export of plywood and veneers, would show that our export trade is quite diverse, though regionwise West Asia is the biggest partner. Next comes the Western Europe. It is also seen that the price per unit obtained from West Asia is much higher than in the case of Western Europe and hence West Asia would offer the most economic advantage. From details of exports to other regions it is found that India does not have any export trade relationship in panel products with Eastern Europe, USSR, Latin America and Japan. If the export promotion is aggressive and quality is assured, it is hopefully expected that export of plywood and veneers is likely to be 50 per cent of the total production in the country in the coming years. Accordingly, we would recommend that the installed capacity in the plywood and veneer industries should be such that production of double the domestic requirement is possible by 1985.

42.4.15 It is not known how much of the hardwood logs imported in Europe and Japan are used as saw, logs and how much as veneer logs. The GATT-ITC study¹ assumed that only about 50 per cent of logs imported are used as veneer logs. So far as India is concerned, rosewood constitutes the bulk of export of round logs. Rosewood logs export is also a matter of controversy as far as panel industries are concerned. A clearer understanding of the situation would be possible if information could be available as to what quantity of the rosewood logs exported is used for veneering and how much for sawing. Japan imports about 50 — 55 per cent of India's rosewood, Italy 12 — 15 per cent and West Germany 10 — 12 per cent. There should, therefore, be a proper market intelligence study in these countries on the end uses of rosewood and the demands for the various types of rosewood veneer. It is to be determined if India is capable of producing veneers of the types wanted in the markets of Japan and Europe.

42.4.16 The Indian manufacturers, however, claim that some of the units in India, having slicers, have produced and exported veneer of varying thickness, which have been warmly appreciated and readily accepted against rigid British and Japanese specifications for quality,

¹ 1967. Major Markets for Tropical Sawwood in Western Europe, Geneva, GATT-ITC.

grain strength and appearance. The industry has made a point that export of rosewood logs should be curtailed, restricted and ultimately stopped, and the plywood industry would be able to export veneer at the end of the Fifth Plan upto a value of Rs. 10 crores starting with Rs. 2 crores a year*. Since we have already recommended that export of roundwood, particularly of species suitable for high grade veneering, should be progressively discouraged, the controversy will end, but the difficulties of aggressive entry into the market of developed countries so far as veneers are concerned will remain. It has been opined that careful consideration should be given to the fact that restrictions on log export and consequent high prices of rosewood veneers as luxury articles may encourage the use of substitutes. In USA, plywood has been the sector with the most dramatic growth, increasing 4.5 times between 1960 and 1969. Projections indicated a coordinated annual growth of 8.7 to 10.5 per cent per year. But despite the success of imported hardwood plywood in recent years, the markets are now being eroded by substitutes, mainly particle boards with veneer, paper or vinyl outlay. This is especially true in case of thicker panels required for use in cabinetry and furniture making. Rapid advances in product upgrading through direct-printed and vinyl outlays have resulted in a technological gap between producers of the raw substrate in the far eastern producing centres and the prefinishing now mostly carried out in USA. There is a genuine possibility of natural products making an impression in the US markets, because the USA is also affected by serious oil crisis as in the case of other industrially advanced nations. There should be no let up in the effort in this direction.

42.4.17 In our opinion, increase in export of panel products to Europe, Japan or USA is not going to be easy. So the strategic market for greater export of panel products should be developed in the West Asian and North African countries. The most critical part about any increase in the export possibility of panel products is the price of synthetic resins. The cost of resins in India is very high, and moreover the resin carries a very high excise duty. We recommend that glue of international quality and at international prices should be made available to plywood factories specifically oriented towards export.

Half Wrought and Shaped Wood Products

42.4.18 Half wrought and shaped wood products include cutlery and tool handles and simply worked or shaped wood which can be finished into toys etc. From the statistics given in Table 42.3 below, it

* In one year alone (1974-75) the export was for over Rs. 7 crores.

TABLE 42.3

Import and Export of Wood, Shaped or Simply Worked¹

Year	Quantity (tonnes)			Value (thousand Rupees)		
	Imports	Exports	Net	Imports	Exports	Net
1969-70 . . .	740	473	(—) 267	1,392	410	(—) 982
1970-71 . . .	604	96	(—) 508	1,335	179	(—) 1,156
1971-72 . . .	960	336	(—) 624	2,483	388	(—) 2,095
1972-73 . . .	2,155	780	(—) 1,375	3,745	777	(—) 2,968
1973-74 . . .	1,173	2,255	(+) 1,082	2,495	1,941	(—) 554

is found that India has been a substantial net importer of shaped or simply worked wood, though the quantity exported in 1973-74 was more than the import.

42.4.19 The Asia 1972 Trade Fair provided a positive proof of the great demand for Indian carved wood toys by the foreigners. India has some timber outstandingly suitable for wood carving. But it should be appreciated that large scale sale of carved wood or wooden toys to tourists is not possible as wooden articles would necessarily be heavy. Since there is a baggage limit for air passengers, purchases of wooden articles by tourists in India must necessarily be limited. Increase in export should be possible through the following processes:

- (i) market intelligence about the kind of wooden toys and articles in demand;
- (ii) opening of shops in foreign countries by Indian entrepreneurs (similar to those in textile, dolls, etc.); and
- (iii) a promotion of exports through the All-India Handicrafts Board.

Organisation of Export

42.4.20 There is little doubt that demand for wood and wood products is considerably on the increase. Also, the prices offered are fairly attractive. It is also equally true that India has timber and timber products to spare for exports in acceptable qualities and quantities, from specific regions. The factors which promote export are:

- (i) stable and competitive prices;
- (ii) sustained supply of acceptable qualities based on international specifications;

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta. Directorate General of Commercial Intelligence and Statistics, Government of India.

- (iii) timely supply;
- (iv) diversification in export commodities;
- (v) adequate market intelligence;
- (vi) attractive export incentives;
- (vii) favourable tariffs, subsidies; and
- (viii) adequate credit facilities on easy terms.

42.4.21 Promotion of export would require a well concerted effort. We recommend that there should be an Export Promotion Council for Forest Products, and it should be responsible for :

- (i) arranging for market studies in different countries;
- (ii) analysing them to advise the Government of India on the correct policy regarding export of forest products;
- (iii) undertaking publicity and promotional activities in prospective markets abroad;
- (iv) regulating the standardisation and grading of sawnwood for export; and
- (v) servicing the Government industrial organisations and private trade about the market conditions abroad.

42.4.22 Needless to say, success in the field of exports can come only if supplies can be guaranteed and quality ensured. On both the counts, we visualise a substantial role to be played by the forest development corporations, now being set up in different States as a result of our recommendations in the Interim Report on Production Forestry — Man-made Forests. The corporations will be in many cases directly responsible for setting up forest based industries, including export oriented ones. Promotion of exports will not only involve collection of market intelligence, but also publicity, training, etc. Finance needed for these export promotion activities should be a legitimate concern of the corporations.

42.4.23 An inventory of resources should be undertaken in the next few years to set up export-oriented forest industries and a suitable training programme should be devised for persons to be in charge of such industries. The Indian Institute of Foreign Trade (IIFT) at New Delhi arranges a few courses for executive officers connected with exports. Training of forest officers should be arranged in consultation with this Institute.

5 EXPANDING INDUSTRIAL USE OF FOREST PRODUCTS

42.5.1 We have pointed out in Chapter 41 on Forest Policy that no planning of forest development would be possible outside the ambit of planning for forest industries. It is necessary to analyse the present

end uses of products, which come out of the forests, and their future trends for proper planning. Due to the lack of a proper information base, it is difficult to trace end uses of forest products. However, in this section an attempt has been made to assess the effect of technology changes, already introduced or which may be introduced in future, on use of forest products, and also to assess the current place in the economy of the following forest based industries: (a) pulp and paper, including newsprint, (b) panel products, and (c) safety matches. As explained in Section 1, we have not discussed the minor forest produce in this chapter, and hence we have not considered the industries based on minor forest produce in this section either.

Effect of Technology Changes

42.5.2 Tropical and sub-tropical hardwood forests are characterised by the presence of a large number of species, a few of which are only commercially marketable at present. They constitute* nearly four-fifths of the total forest area. For the Andaman & Nicobar Islands, 310 tree species have so far been recognised as constituents of the tropical moist forests of the Islands, but only 24 of them are considered 'commercial'. A recent enumeration has shown that while 75 m³/ha is the growing stock of 'commercial' timber, there is a further stock of 175 m³/ha of 'non-commercial' timber. In such situations, selective harvesting of the preferred species is undertaken. It is wasteful of wood resources, harmful to future wood production and costly in the use of resources.

42.5.3 In order that India can enter the export market aggressively after meeting the domestic requirement or substitute imports of products like newsprint, the range of species and quality of timber utilised must continue to be extended. The extension of utilisation and increased recovery from tropical forests are likely to be achieved most economically through local processing. In this connection, we may mention some of the advances made in the developed countries in the utilisation of forest raw materials: (a) low quality logs and log residues are being chipped at log stations within the forests; (b) the technology for pulping saw dust for the production of newsprint is far advanced and is in use; and (c) use of small logs, both softwood and hardwood, has been successfully made for the production of construction plywood with the help of high speed lathes.

42.5.4 The main problem in the adoption of such developed technology would, of course, be one of scale. The economies of scale

* Table III, pp 15-16, of the Report of the Task Force on Forest Resources Survey (July 1972) of the Planning Commission may be seen. We have excluded tropical thorn forests, which constitute about 6.9 per cent of the total forest area.

in the developed and developing countries cannot be the same. Moreover, a developing country may not be able to afford the minimum level of investment needed to adopt a particular technology developed in the western countries. We are confident that, with the vast scientific and technical manpower, India can successfully meet the challenge of research and machine-tools manufacture for adoption of the advanced technology with necessary modifications. It has been reported* that an Indian tool-maker exhibited a universal wood working machine in the Indian Engineering Trade Fair held in Delhi in February, 1975. While the Swedes, for long world leaders in wood working machine, sell their standard unit capable of six operations in the equivalent of Rs. 30,000 the Indian tool-maker sells his combine with detachable drives geared for ten operations for just half that price.

42.5.5 The change effected in raw material production from forests as a result of new technology is illustrated by the use of bamboo as a pulping material. Natural bamboo forests cannot be worked for production of bamboo only, because it will lead to a low productivity. The cost of artificial regeneration of bamboo is generally high, and hence a remunerative price is often beyond the capacity of the pulp industry to pay, though as a construction material bamboo from plantations can fetch an economic price. Silviculturally, concentrated bamboo plantations have not been much of a success. Moreover, recent experiments with tropical pines have shown that tropical pine can be grown in similar areas and is expected to give a much higher output as compared to bamboo plantations. The changes that we visualise in the consumption of various cellulosic raw materials for the pulp and paper industry are given in Table 42.4.

TABLE 42.4

Past and Projected Percentages of Consumption of Various Cellulosic Raw Materials in Pulp and Paper Industry

	1958-59	1970	Projected (low estimate)		
			1980	1985	2000
bamboo	70	51	32.0	31.1	14.8
hardwood	4	24	45.4	46.0	49.4
softwood	1	3	16.2	16.4	24.3
bagasse	3	5	0.8	0.8	2.8
imported pulp	5	neg	..	..	..
agricultural residues, waste paper and others	17	17	5.6	5.7	8.7

In Appendix 42.8, we have given our assumptions for the projected pulp mix for the production of different categories of paper.

* Yojana (a monthly journal of the Planning Commission), Vol. XIX (3) dated March 2, 1975.

42.5.6 In our demand projections till 2000 AD, we have assumed that particle board and fibreboard production would be mainly from forest and agricultural residues. But the manufacture of fibreboard from mixed tropical hardwoods, currently technically feasible, may soon become economically feasible, allowing more complete utilisation of wood fibre. With the substitution of panel products for sawn-wood, less than half the wood volume is necessary. So it will be necessary to develop technology and equipment for utilisation of non-commercial hardwoods in the panel industry, and particularly for a simultaneous use of a variety of wood species to assure closer utilisation of the mixed tropical forests. Though fibreboard, of all wood based panels, is the most tolerant to the simultaneous use of a variety of wood species, in current mill practice the number of simultaneously used wood species does not exceed 25. Research is required to be initiated from now on, so that this number is considerably widened for application in India's fibreboard and pulp industries.

42.5.7 There may be a competitive demand for the same kind of raw materials by different forest industries, for instance pulpwood by paper industry as well as particle board and fibreboard industries. Particle board and fibreboard consume about 10 per cent of the world production of pulping wood chips and residues. The proportion varies with regions; thus, these industries use 5 per cent of total pulpwood production in North America, 7 per cent in Asia and 20 per cent in Europe. In Germany, however, more than 50 per cent of pulpwood consumed in the country is used by these industries.

Pulp and Paper Industry including Newsprint

42.5.8 The consumption of newsprint, paper and paper boards has steadily increased since Independence. Even so, the per capita consumption in India is almost the lowest in the world. A Committee of the Planning Commission indicated¹ that in 1964 the annual per capita consumption of pulp, paper and paper products including newsprint in India was 1.4 kg, as compared to 7 in UAR, 16 in USSR, 57 in Japan, 106 in UK and as much as 205 in USA. A consumption of 4 kg per capita was considered by the Committee as the barest minimum, if a reasonable stage of development has to be reached.

42.5.9 In 1970, the per capita consumption was about 2 kg. Even though the per capita consumption did not reach a high level, the progress in indigenous production in absolute terms was quite

¹ 1965 (September). Study on Forest Raw Materials for Pulp Paper and Newsprint, New Delhi, Committee on Natural Resources, Planning Commission, Government of India.

phenomenal. In the case of paper and paperboard, the total consumption increased from about 181,000 tonnes in 1948 to 729,000 tonnes in 1970; the indigenous production rose from about 98,000 tonnes to 742,000 tonnes. In newsprint, the consumption in the same period rose from about 44,000 tonnes to 175,000 and production from nil to 34,000 tonnes. For the development of forestry, it is necessary to know the specific requirement of the types of raw material required by the industry, and hence it is appropriate to analyse the historic consumption pattern of different types of paper and paperboards. Table 42.5 has been constructed from the Report of the FAC Conference¹, the study by Prof. G. R. Gregory referred to in Appendix III of our Interim Report on Production Forestry—Man-made Forests and estimates of demand made by us for 1980, 1985 and 2000 AD.

TABLE 42.5

Consumption Pattern of Paper and Paperboards Excluding Newsprint

('000 tonnes)

Year	Printing and writing paper	Industrial paper*	Paperboard
1948	99.9(50.5)**	52.2(26.4)	45.8(23.1)
1958	170.6(51.5)	60.4(19.8)	95.0(28.7)
1970	405.0(55.6)	158.0(21.7)	166.0(22.7)
1980 (low estimate) . .	733.0(56.1)	244.0(18.7)	330.0(25.2)
1985 (, ,)	935.0(56.1)	319.0(19.1)	413.0(24.8)
2000 (, ,)	1,777.0(54.6)	701.0(21.6)	776.0(23.8)

*Industrial paper consists of absorbing tissues and other industrial paper.

**Figures in the brackets show the percentages in the year's total consumption.

Because of the control of import and distribution of newsprint, the apparent consumption upto 1970 does not correctly represent the true level. In the paper and paperboard segment, the demand for industrial paper remains depressed due to widespread use of old newspapers for packaging in grocers' shops, etc.

42.5.10 According to the licences taken out for expansion of existing industries or installation of new ones, the installed capacity by 1973-74 is likely to be only 1.3 million tonnes against a requirement of 2.1 million tonnes. A crash scheme evolved in 1970 for making available additional 0.1 million tonnes of paper and paper products by the end of 1972 did not succeed. Shortage of raw materials, high capital intensity and fluctuating trends in profitability are said to be the main reasons responsible for this stagnation.

¹ 1962. Proceedings of the Conference on Pulp and Paper Development in Asia and the Far East, Tokyo, Oct. 17-31, 1960. Rome FAO.

FIG. 42.3

(PARAGRAPH 42.5.12)

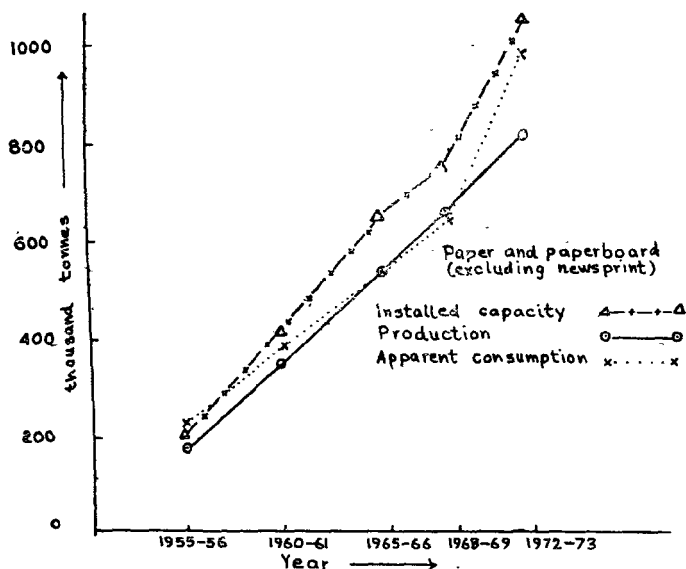
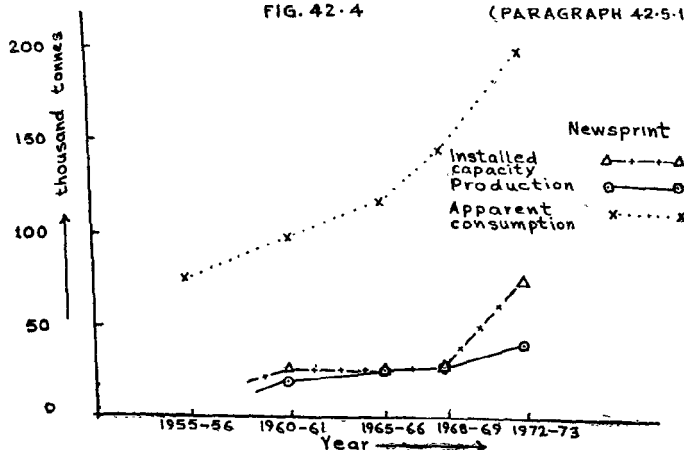


FIG. 42.4

(PARAGRAPH 42.5.12)



42.5.11 In a Seminar on High-yield Pulping and Newsprint Manufacture organised by the Indian Pulp and Paper Technical Association (IPPTA) at New Delhi on December 14, 1973, it was mentioned by the industry that the additional capacity licensed by the Government several years ago has not been installed, mainly because the rigid price control did not permit adequate return. The importance of using alternative raw materials like recycled fibre from waste paper, wheat and rice straw and bagasse was stressed. It was also suggested that if chemical pulp was available from mother pulp mills, the capital cost of setting up newsprint mills would be reduced, and even small and medium entrepreneurs would be able to set up newsprint plants.

42.5.12 Even without going into the controversy of the causes of shortfall in installed capacity in the paper and paperboard industry, note has to be taken of the fact that adequate capacity is not being added to this industry. A production forestry programme cannot be undertaken without assuring simultaneous growth in forest based industries, notably paper and pulp industry. In Figures 42.3 and 42.4 we have represented graphically the position with regard to the installed capacity, production and apparent consumption in respect of paper and paperboard and newsprint respectively. It is seen that in the case of paper and paperboard the installed capacity has been able to keep pace with consumption, but the production has almost always been below the apparent consumption. In the case of newsprint the apparent consumption is very much more than the production. As a result of this substantial imports had to be made to meet the consumption needs in respect of these products. The imports from 1969-70 to 1974-75 had been as follows:

					('000 tonnes)
				Import of paper and paperboard, other than newsprint	Import of newsprint
1969-70	.	.	.	12.5	155.1
1970-71	.	.	.	14.7	144.2
1971-72	.	.	.	14.3	206.8
1972-73	.	.	.	21.7	153.8
1973-74	.	.	.	17.0	117.0
1974-75	.	.	.	16.1	141.1

42.5.13 Regarding rayon grade pulp, the actual output in 1973-74 was around 87,000 tonnes against the installed capacity of 113,000 tonnes. It is estimated that an additional installed capacity of 117,000 tonnes is necessary to meet the requirement by 1980, and the outlay is

likely to be Rs. 75-80 crores. The necessary plant and machinery are mostly available from indigenous sources. Some of the equipment, like recovery boilers and digesters, may require certain imported components. If, however, instead of the flash drying method the sheet forming method is used, the additional cost may be 10-15 per cent, to be paid in foreign exchange. However, there is a good prospect of the export of rayon grade pulp, in view of the high price and demand in the world market.

Panel Products

42.5.14 There are 95 big and small plywood units in the country. Of these, 29 factories belong to the 'big' category, and come under the surveillance of the Director General of Technical Development. Their installed capacity is 43 million square metres. The factories are located mainly in Assam, West Bengal, Kerala, Karnataka and Andaman & Nicobar Islands. Production during 1971 and 1972 has been 27.5 million sq. m and 32 million sq. m respectively. Additionally, there was a production of about 7 million sq. m in the small scale sector.

42.5.15 In view of the rapid increase in production and high expert-orientation, the following weak links in the chain need consideration in future development :

- (i) availability of a steady supply of ply logs, and adequate installed capacity to coincide with availability of new resource ;
- (ii) availability of adhesives of international quality at international market rates ;
- (iii) introduction of technology, by which the industry could scale down its rigid specifications of ply logs, as to size, shape and species ;
- (iv) policy towards export of round logs, particularly of species which are suitable for high grade veneering ; and
- (v) availability of machinery for production of better quality veneers, for instance door skin sizes of 3.2 mm thickness, so much in demand in UK.

42.5.16 The record of production of particle boards and fibreboards in India is dismal. From 1961 to 1965 at least some growth was noticed. But from 1965 onwards the production of particle boards had virtually remained stationary while only a small increase in fibreboard production was noticed. There are six units licensed to produce fibreboard. For particle boards, there are 26 factories, in respect of which licences have been issued for production, but the

dismal record of production shows that most of them have not yet been established and/or started production. Even in established factories, actual production is very much below the annual installed capacity as the figures below¹ would show :

Industry	Annual installed capacity	('000 tonnes)	
		1969	1970
particle board	44.9	9.9	7.9
fibreboard			
(a) compressed (hard)	34.6	22.7	22.0
(b) non-compressed (insulation)	6.0	2.1	1.8

42.5.17 Since particle boards and fibreboards make a greater use of secondary raw materials and residues from logging, saw mills and other industries, the poor record of these two categories of industries may have to be looked into, so that corrective steps can be taken, and forestry can make a greater impact on the total economy. In the world scene, the output of particle board is expanding at nearly 14 per cent per annum. If proper processing technology is used, marketing is aggressive and the research needs are taken care of, there is no reason why the particle board and fibreboard industry cannot meet the domestic needs to obviate the use of teak, *sal* and *deodar* for all and sundry purposes, a luxury which India can ill afford.

Safety Matches

42.5.18 The use of wood for burning is as old as fire itself. The development of matches is just a technological advance. The match industry combines one of the basic uses of wood with a vital need of man. The demand for matches is increasing. The Planning Commission has estimated requirements and the corresponding matchwood consumption as follows²:

Year	Estimated requirement (million match boxes)	Estimated matchlog requirement (m ³)
1973-74	11,500	381,700
1978-79	14,000	485,000
1998-99	37,000	1,283,900
2000 AD	38,590	1,339,100

¹ 1972 (February). Forest Statistics Bulletin No. 13—Removal of Wood and Bamboo, New Delhi. Central Forestry Commission, Ministry of Agriculture Government of India.

² 1969. Matchlog Requirements—Trends and Prospects, New Delhi. Working Group Study, Planning Commission, Government of India.

A comprehensive survey of matchwood resources, however, has yet to take place. Indications are that without vigorous steps to augment resources, a serious matchwood famine may well be imminent. In match manufacture, certain basic wood attributes are a prerequisite, relating as they do to such important aspects as technological processes in production, reasonableness of price and the quality of the finished product, consumer preferences, etc. All wood therefore is not matchwood.

42.5.19 Before World War I, most of the country's requirement of about 15 million gross match boxes annually were met by import, mainly from Sweden and Japan. After 1918, Sweden increased its export to India. In 1924 two factories were built by them for indigenous manufacture, one at Ambarnath near Bombay and another near Calcutta. Between 1924 and 1929 two more factories, one close to Madras and the other near Bareilly in Uttar Pradesh, were established. A unit was also set up in 1929 at Port Blair in Andaman & Nicobar Islands to manufacture undipped match sticks for the mainland factories. All these became part of Western India Match Co. Ltd. (WIMCO) which was incorporated in 1923. A small associated company named the Assam Match Company Ltd. (AMCO), was incorporated in 1925 with a factory at Dhubri in Assam. At present WIMCO/AMCO produce about half of the total production of matches in the country.

42.5.20 The Annual Survey of Industries, 1966 (Central Statistical Organisation), the latest published so far, shows that in the census sector* there were 41 factories in existence, 26 of them being in Tamil Nadu, 3 in West Bengal and 1 each in Andhra Pradesh, Assam, Jammu & Kashmir, Kerala, Madhya Pradesh, Maharashtra, Karnataka, Uttar Pradesh, Andaman & Nicobar Islands, Tripura and Goa, Daman and Diu. The total number of factories, employment and production have come down considerably since 1960, though the productive capital employed and gross value of output have sharply risen. The Table 42.6 gives the relative position. The details of statistics given in the Annual Survey of Industries show that the factories in Tamil Nadu are comparatively small scale industries. In 1966, on an average each Tamil Nadu factory consumed about 70 m³ of matchlogs against 11,500 m³ for West Bengal. The average gross value of output per factory was about Rs. 18 lakhs in Tamil Nadu against Rs. 87

* Factories employing 50 or more workers with the aid of power and 100 or more without the aid of power.

lakhs in West Bengal. According to Central Forestry Commission* there are 76 units in all sectors for the manufacture of safety matches and splints, 55 of them in Tamil Nadu, 7 in Assam, 3 in Karnataka, 2 each in West Bengal and Bihar and 1 each in Maharashtra, Jammu & Kashmir, Kerala, Madhya Pradesh, Orissa, Uttar Pradesh and Tripura. Except 5-6 units of WIMCO/AMCO complex, all are in the small and medium category.

TABLE 42.6
Production of Match Industry in India¹

	Unit	1950	1960	1966	1969
number of factories . . .	number	54	55	41	43
persons employed . . .	number	12,805	15,628	13,201	14,084
production (boxes, each with 50 lights) . . .	million number	4,669	6,630	5,569	5,567
productive capitalemployed	Rs. in crores	2.18	4.32	7.23	7.55
gross value of output . . .	Do.	6.54	10.47	14.80	19.76

42.5.21 Safety matches are an essential basic consumer commodity needed by all sections of the community. The demand for matches is increasing. The consequences of short supply in the market are not difficult to imagine. Most of the matchwood comes from Government forests, and hence the Government has a direct responsibility to keep the wheels of this essential industry running. The Indian Standards Institution (ISI) has listed a number of species suitable for match production. While allotment could be made of such suitable species from the current harvests, there is need to take up adequate extent of plantations for augmenting matchwood resources. Generally, plantations of *semul* (*Bombax ceiba* Linn.) or other matchwood species are not created pure, for silvicultural reasons. The species are planted at wide spacings in plantations of teak or other species. In addition to raising plantations of traditional matchwood species, poplar (a good matchwood species) should be raised where feasible in pure plantations in forest areas and encouraged for planting under the programme of farm forestry. The State Governments should not only take the price of raw material into consideration but also other financial benefits, such as excise duty and sales tax, that would accrue to the Government on production and sale of matches, and take up an aggressive programme of raising matchwood plantations.

* Bulletin No. 10, April, 1970.

¹ 1950, 1960, 1966, 1969 (draft). Annual Survey of Industries (Census Sector), Calcutta Central Statistical Organisation (Industrial Statistics Wing), Department of Statistics, Government of India.

42.5.22 The growing demand of the match industry should be met, both by conserving the existing resource and by creating new plantations. More important immediate and long term measures in this regard could be listed as follows :

- (i) reservation of all matchwood species as listed under the Indian Standards Specification for Logs for Matches—IS : 1140-1970 for the exclusive use of the match industry;
- (ii) promoting and tending natural regeneration of matchwood, wherever possible (e.g. parts of Andamans);
- (iii) research on maximising yield from matchwood plantations;
- (iv) implementation of an intensive programme for raising matchwood plantations on a large scale; and
- (v) expansion of large scale matchwood industry, particularly for making splints and veneers, may be confined in future to the Andaman & Nicobar Islands, in view of the shortage of matchwood in the mainlands.

6 LOGGING AND MECHANISATION

42.6.1 Harvesting of wood (called logging) should be considered as one of the principal operations in forestry. The best overall economic results from forestry as a whole cannot, however, be realised only by choosing the best of the available economic methods and means of logging and their optimum applications. It is imperative that all branches of forestry, i.e. silviculture, logging and marketing, are properly coordinated.

42.6.2 Logging in India has paradoxically enough remained at best an undertone only. Whereas the general research and investigations on biological aspects of forestry are very advanced, progress in logging development is poor. One of the reasons is that logging has been left entirely to the contractors, and the process was not so far linked with the possibility of maximising economic gains for forestry in the country as a whole. There were other reasons too, namely the low logging costs largely originating from cheap labour and, as a consequence thereof, more or less exclusive reliance on manual operations. With the present trend of the increasing shortfall in the number of hands available for forestry works and their rising wages, as well as to make it possible to pay the labour higher wages with acquisition of skills, the logging operations are becoming costlier. Choice of the best economic possibility, specially when we are recommending forestry to be regarded as a commercial enterprise, would require adoption of the most economic method of logging, so that not only costs are

reduced but also increased yield per tree of increased value thereof are realised, together with improved silvicultural practices and utilisation of the industrial wood.

A Review

42.6.3 The main tools for felling had been the axe and the saw. Till about the middle of the nineteenth century the axe in its most incipient form was the sole logging tool for the felling and shaping of wood. This resulted in very high wastage as the tool could be used only at a certain height above the ground. Even now the contemporary practice in the Himalayas in the north, as well as some coppice forests in southern West Bengal, is equally wasteful. As trees are felled at convenient heights from the ground, it results in stumps from about 0.5 m in the plains to as high as 1.5 m on slopes in the hills. Such stumps are a great obstruction in rolling the logs down and many of the logs are left behind *in situ* after they get jammed within these high stumps. The use of the saw in felling was started for the first time around 1852. The saw, however, did not become a popular tool till very recently.

42.6.4 Regarding transportation it was done both manually and by draught animals (either in pack form or wooden wheeled carts). Loading and unloading of wood were invariably done manually; at best wooden poles were used as a lever for turning or rolling wood. In Southern and Eastern India and in Andaman & Nicobar Islands handling and hauling of wood were often done by elephants. On slopes advantage was taken of the force of gravity. For long distant transport however the mode of transport was by water, of course only for those timber which could float easily.

42.6.5 Gradually improvements came to be introduced in the logging. Apart from widespread introduction of saw for felling, conversion in the Himalayas at stump site so as to reduce wastage during transport came to be introduced and other improvements made were the transport practices by laying of proper timber chutes, slides, extraction trails, cart roads, improving floating capacity of the rivers, construction of booms in the plains for collecting timber floated down the rivers, construction of permanent and temporary roads in the hills and the plains, etc. The Government of India also set up a Forest Engineering Service after the World War I and attached it to the Forest Departments. These engineering personnel helped the various Forest Departments in improving the means of communication specially in difficult terrains and also in initiating mechanisation of logging operations. Such mechanisation consisted of, amongst others: (a) high-lead yarding and skid-mounted steam logging engine with

main and rehaul cables as in North Bengal ; (b) use of such engines as 5-ton 4-cylinder Holt caterpillar tractor of 40 HP and Fordson tractors of 40 HP in Kerala and Tamil Nadu States ; (c) Fordson tractor of 32 HP with Tom-Huston special winch run on kerosene, and bullock and buffalo driven American special winches in Karnataka ; and (d) forest tramway lines in the Andamans, Uttar Pradesh and Assam, etc. The twenties were further marked by introduction of Donald's Gravity Ropeways in Punjab (the sites are now in Himachal Pradesh) and Uttar Pradesh for timber extraction.

42.6.6 After a slump in the thirties which resulted in a halt of all types of mechanisation and in improved transport facilities to bring out more timber from the forests, logging development again started looking up after the World War II. The demand of timber rose very high with the consequent rise in prices. Road transport of wood by trucks emerged as the dominant feature of the period; felling and extraction in the forests however retaining the old pattern, namely use of country axe and saw only by the contractors to whom the timber coupes continued to be sold standing. Due to the development of wood based industries and increased construction activities, there were increasing demands on the wood resources and forest residues. This influenced the logging practices to some extent; timber in log form started to be increasingly taken out from the forests all over the country except in the Himalayas, as off-cuts, slabs and other conversion residues found ready market. Likewise establishment of the packing case industry and pulp and plywood industries etc. rendered working of the remote high mountain coniferous forests economical. The lesser known species hitherto designated as non-commercial also started attracting demand.

Recent Developments

42.6.7 In pursuance of the urgent need of improving the logging techniques in the country, the Government of India took steps to set up a Logging Branch in the FRI in 1957 for conducting research in the logging problems of the various Forest Departments. Subsequently a logging training centre was organised in 1958 for a period of 4 months at Batote in Jammu & Kashmir under the supervision of an FAO Expert. At this centre training was imparted to future instructors in the field of basic logging and handling of mixed equipments such as skyline cranes, tractors, portable saw mills, etc. By this time the need for a rational approach to wood harvest was well recognised by most of the Forest Departments of the country. The Logging Branch of the FRI held demonstrations from time to time throughout the country in the maintenance of modern hand tools and

were also conducting time and cost studies for various operations under different conditions.

42.6.8 It was very soon felt that training in use of modern tools for wood harvesting, including felling and transport, should receive the foremost attention in the forestry sector if efforts in improving the current practices were to make any practical progress. With this idea came into being the Logging Training Centres Project, which was established by the Government of India in collaboration with Special Fund of the United Nations in September, 1965. The collaboration of the FAO continued till August, 1969; after that the project is continuing as a Central sector effort. It is running four training centres in various parts of the country—one at Dehra Dun for the northern zone States, one at Chandrapur (Maharashtra) for the central zone States, one at Coimbatore (Tamil Nadu) for the southern zone States, and the fourth at Sukna (West Bengal) for the eastern zone States.

Current Logging Systems and Practices

42.6.9 The forest labour, engaged by contractors to whom timber coupes are sold, still relies on the centuries' old axes, saws and wedges, etc. to harvest the crop. Use of improved tools or other forms of mechanisation is an exception rather than the rule. Practically throughout the country felling and cross-cutting is done on piece rates. Each woodman brings his own tools and maintains these himself with the knowledge acquired through experience only. Regarding the tools and methods adopted for logging, axe is still the common tool for felling of trees and for trimming and splitting. Bill hooks are generally used for felling of bamboos and small poles and for cutting brushwood. Saws are generally used for felling, cross-cutting and ripping logs into planks, scantlings, sleepers and other classes of converted material. Generally two types of saws are used—cross-cutting saws and ripping saws. Apart from very limited use of basic logging tools and power chain-saws in some parts of the country, partial mechanisation in the felling of trees has been adopted in some States. In West Bengal a tractor with tree dozer attachment has been used for uprooting trees, and the same tractor with other attachment and tools has been used for various other jobs like road making, site clearance, ploughing of clearfelled areas, etc.

42.6.10 Transportation of timber after harvesting probably accounts for 60 per cent of the total expenditure on logging. At present off-road transportation is generally done by the following processes :

- (i) Skidding, either by gravity or by animals. As mentioned earlier elephants are also used in some places.

- (ii) Carting with bullock or buffalo driven carts. This is fairly extensive in this country, and primitive type of wooden wheels are still in use, though lately use of pneumatic tyres are being increasingly done.
- (iii) Carriage by men and pack animals. Carriage of sleepers and fuelwood on human backs is a fairly common sight in the Himalayan forests.
- (iv) Transport by aerial ropeways. Donald's Gravity Ropeways are fairly extensive in the Western Himalayas. Other form of gravity ropeways have also come into use and a modern one installed in the Eastern Himalayas in West Bengal has a span of over 4 km. These gravity ropeways are being increasingly serviced by skyline cranes and various other power cable cranes. In the Himalayan forests in West Bengal a Swiss tractor mounted power winch and a short range (500 metre) Czechoslovak gravity ropeway are in use. The advantages of these are that they are very mobile.
- (v) Timber slides. Various types of timber slides such as earth slides, dry slides, wet slides or flumes are used in the Himalayan forests.

42.6.11 Major transportation by land is done by trucks and railways. Generally only 5 tonner trucks are used and in the hills only 1-1/2 to 3-tonners. The forest tramways started in earlier times in different States have mostly been closed down, except in the Andamans. Transport by water is also still practised, particularly in the Western Himalayas. It is done either by free floating or rafting. The river Tons in Uttar Pradesh still remains one of the major water transportation media.

Suggestions for Future Logging and Mechanisation

42.6.12 The question of the degree of mechanisation to be adopted in forestry operation has been thoroughly considered by us in the light of the experience recently gained in some States. Apprehensions about unemployment in a labour surplus economy, high initial capital cost, absence of maintenance facilities in remote areas, etc. have also been considered. We have come to the conclusion that in the present state of affairs, a selective mechanisation must be adopted, so that any impediments in opening up of inaccessible forest areas may be removed. It has been found in recent studies on mechanisation in small-size and medium-size farms in the case of agriculture that mechanisation upto a certain level increases the labour potential. In forestry too a small amount of labour replacement in mechanisation of logging may be more than offset by increased labour requirement,

if forests are exploited to their full potential and if complementary steps are taken for mechanisation of site clearance and production of subsidiary crops, along with the main forest crops. In short, selective mechanisation should be taken up so that (a) a reduction in logging and transport cost takes place, (b) it is possible to open up inaccessible areas early, (c) increased volume production takes place from each hectare of land, (d) site clearance, wherever possible, as for instance in the plains, is mechanised in a way that a supplementary agricultural activity (e.g. *taungya* method) takes place requiring more labour, and (e) it is possible to offer continuous sustained employment at reasonable minimum wages to the persons engaged in logging.

42.6.13 In this connection we may quote the experience of West Bengal in the matter of mechanised logging.¹ Apart from the use of the tree dozer mounted on tractor working in the plains, a good beginning in mechanised logging and extraction of logs by ropeways has been made in the hill forests since 1966. The following mechanised equipments are in use :

	Haulage distance (metres)
1. Kupfer short distance skyline crane	300
2. Czechoslovak VLU-4 transport cableway	500
3. Hinteregger all terrain skyline	2,000
4. Off-road transport of logs from the felling areas to the main road is done by Swiss gravity conveyor Lass 0-35	4,000

In Table 42.7 we have shown the comparative cost.

TABLE 42.7

Comparative Cost of Mechanised and Manual Logging in Hill Forests of West Bengal

Type of cableway	Range (metres)	Cost of hauling (Rs. per m ³)	Cost of logging & hauling (Rs. per m ³)	Cost of manual car- riage (Rs. per m ³)
Kupfer skyline	300	7.44	16.44	20.00
VLU-4 cableway	500	10.66	18.00	40.00
Hinteregger skyline	2,000	12.28	20.00	80.00

The above table shows that in the hill forests, for any economic logging operation, the use of ropeways is indispensable. Well stocked and extensive forests of mixed hardwood species of moderate value

¹ 1973. Project Report for the Development of Under-developed forests in North Bengal through the Agency of West Bengal Forest Corporation Private Limited, Calcutta. Directorate of Forests, Government of West Bengal.

were not worked in the past due to lack of communication and difficulties of timber hauling in a difficult terrain in the Himalayas. The problems of logging and timber hauling have been successfully solved by the use of the mechanised equipment referred to above.

42.6.14 Modern methods of mechanised logging by improved tools, skyline and cableways in the hilly terrain offer the following positive advantages :

- (i) wastage of timber due to high stumps and felling breakage is avoided ;
- (ii) extraction of timber in log form and machine sawing reduces wastage occurring in field sawing and increases outturn by at least 30 per cent ;
- (iii) lops and tops may be extracted and used as pulpwood ;
- (iv) increase in efficiency of labour, reduced cost of production and faster output may be realised ; and
- (v) extraction of even comparatively less valuable secondary hardwoods is possible at an economic rate.

42.6.15 Regarding mechanisation of planting operations, we do not recommend it either in nursery operations or in planting, except in pockets of very high wages and dearth of labour provided the required number of skilled workers may be obtained. Regarding the plains forest, it may be advantageous in many places to uproot the trees by dozers, followed by site clearance with dozer attachments and then tractor cultivation which would permit growing of many arable crops presently in short supply along with planting of forest species. Beyond this, no mechanisation is called for.

42.6.16 In a study¹ it was concluded that while mechanisation could bring down the cost of harvesting to Rs. 288 per ha compared to a manual cost of Rs. 500, the employment went down from 100 man-days to about half a man-day. But site clearing (windrowing), an operation which could not be done by manual labour, increased the demand for labour. Similarly, the ploughing and subsequent raising of agricultural crops like oilseeds also increased the demand for labour. Moreover the total wood outturn increased from 90 m³ per ha in manual working to about 106 m³ per ha in mechanised working, an increase of about 18 per cent. In the context of the shortage in wood production and in arable crops, the question of introduction of mechanisation should be actively considered. In Uttar Pradesh, also such mechanised ploughing and departmental *taungya* have been adopted for long. The only danger in such cases would be if vested interests are allowed to interfere in the growing of forests crops which may be surreptitiously removed at many places to convert the land

¹ Lahiri, A. K., 1968. Economics of Mechanised Harvesting, Ind. For., 94(6).

into croplands. There must be a very strict watch that the essential principles of *taungya* are not violated and inter-cropping not allowed for more than 3 years, unless a perennial crop can be found for introduction under shade. The territorial Conservator of Forests concerned should be made personally responsible to see that no abuse of such mechanised processes for converting forest lands to croplands takes place through vested interests.

42.6.17 The adoption of tree-dozing and full-tree logging will be capital-intensive. The foreign exchange requirements for capital equipment and components are high. We do not recommend any large-scale adoption of this strategy, except in limited areas. The practice can only be adopted in the plains, and should be confined to areas with high unit price of timber and introduced after proper economic study. For mechanisation in forestry, emphasis should be on mechanical innovations of lower technical sophistication, such as skyline cranes, ropeways, mountain tractors and improved logging tools. This will assist development of local manufacturing which is less demanding in its technical requirements and which is characterised by lower capital-labour ratios and lower foreign exchange content.

42.6.18 In general we would recommend the use of improved basic logging tools. For felling and cross-cutting, the use of bow saws and raker cutter saws is recommended; the former for felling trees and poles upto 30 cm in diameter and the latter for felling higher girthed trees. The specifications of these tools should be the same as those used for training in the UNDP/FAO/Government of India Logging Training Centres Project. Besides, use of proper type of wedges and hand tools is also recommended. The Logging Branch of the FRI should be energised so that it can play an effective role in preparing blueprints for logging in different States and supply the necessary technical information and otherwise service such projects.

42.6.19 For loading and unloading mechanisation should be adopted only where the quantity of timber to be handled annually is large. The machine that may be introduced is a log loader, a hydraulic lifting device, which can be installed on a vehicle. It has been observed that it takes two to three hours to load one truck with manual labour, whereas in mechanical loading it takes only about 40 minutes. Wherever the quantity to be handled would be large a situation is bound to arise where a dearth of labour would be noticed in the concentrated working seasons.

42.6.20 The slow adoption of mechanisation and use of basic improved logging tools for forestry has been due to one important factor, i.e. non-availability of suitable indigenous machines and tools. Of course, finance is another bottleneck. With the commercialisation of production forestry that we have recommended, the projects that will

continue to be prepared for intensive forestry operations can take account the requirement of funds. Regarding developing suitable machines and tools indigenously, the manufacturers showed little interest at first due to low demand in the initial stages. We urge the Logging Training Centres Project and the Logging Branch of the FRI to continue to keep the dialogue going between the State Forest Departments and the manufacturers, so that selective mechanisation and use of improved basic logging tools that we have recommended may be put into operation.

Agency for Logging

42.6.21 India has adopted as a guiding policy in its planning that provision of sustained employment at reasonable minimum wages must be ensured to the weaker sections of the population. Hence the entire logging operations in the forests should be such that this principle is duly implemented. A particular responsibility falls on Forest Departments in this respect, because forests are State-owned and hence the logging operations are directly under the State auspices. It is often the practice, because of the inability to set up an adequate supervisory organisation and due to the tendency to play safe in audit matters, that sub-contracts are given for different operations, even in departmental working. It is hardly possible for the State to ensure payment of reasonable minimum wages to the labourer or to ensure employment of local skilled and unskilled labour in such cases. Moreover there is a reasonable apprehension that allowing the contractors inside the forests may lead to unauthorised removal of valuable forest materials. We therefore recommend that in the departmental operation direct employment of local labour should be secured. It is possible to fix a piece-rate in such a way that audit requirements can be met and the labourers can also get a reasonable minimum wage. One variant of direct employment of local labour would be to set up forest labour cooperatives. But in such cases extreme care should be taken that no vested interests should come into the cooperatives as office bearers, and none but the workers who toil have any say in the running of the cooperatives. In this connection we refer to our suggestions in Chapter 41 on Forest Policy.

42.6.22 We also recommend that as far as possible no sale of timber standing in the forests should be made. After departmental logging, either through direct employment of local labour or through labour cooperatives, all timber should be brought to a sale depot outside the forests and sale should be made at that point only.

42.6.23 Departmental logging makes it easier for opening of fair price shops for supply of essential forest commodities. Supply of charcoal to Darjeeling has been the concern of the West Bengal Forest Department for a long time through departmental working. Though the works have not been commercialised, proforma accounts are prepared for showing the profit and loss during the year of operation. The State Trading Scheme in Rajasthan includes opening up of fair price shops for fuelwood etc. for the weaker sections of the population. The system is working satisfactorily and has prevented not only undue rise in prices, but also pilferages from the forests by contractors. Sometimes a forestry programme is taken up for supplying a particular commodity in an area. An instance of this is the *Casuarina* plantations on the sandy coastal tracts near Puri in Orissa for supply of fuelwood to the pilgrimage centre. Along with the departmental operations, the feasibility of setting up fair price shops for supply of fuelwood and small timber to the rural communities should be considered.

7 INFRASTRUCTURE AND INPUTS

Infrastructure

42.7.1 Three items are to be considered in the infrastructure for any project : (a) roads, (b) buildings and (c) contingencies, but road is by far the most important of infrastructure. An efficient system of communication is a *sine qua non* for proper development of the forests and a complete utilisation of the produce. We have tried to obtain the information regarding the density of forest roads within the forest areas in different States. The roads passing through the forests are mostly constructed and maintained by the Forest Departments, but there are always a few arterial roads maintained by the Public Works Departments. It is particularly in Jammu & Kashmir, Andaman & Nicobar Islands and Arunachal Pradesh that the roads under the control of other departments passing through forests are of much higher density than forest roads, and forest extraction has to depend much on roads constructed and maintained by other departments. We have given in Appendix 42.9 the density of forest roads in some of the States and Union Territories, on the basis of forest roads under the control of Forest Departments only. The average for the reporting States work out to 0.16 km/sq km which

may be rounded off to say 0.20 km/sq km. While devising a national target (regional or State targets would have to be worked out through formulation of projects), consideration should be given to the fact that roads built and maintained by the Public Works Departments, district local boards and Border Roads Organisation would be available for infrastructural support to the production forestry programme. We find that the Logging Training Centres Project of the Government of India has made some excellent suggestions for the calculation of road density, with a view to finding the minimum cost combination of road building, road transportation and off-road transportation.¹ There are two main types of roads concerned with forestry, i.e. temporary and permanent roads. Temporary roads are those simple roads which are intended to last one logging season only and hence costs on their account could be regarded as direct logging costs. Permanent roads on the other hand serve a variety of transportation work and are meant for longer periods. These have, therefore, to be regarded as investments. In the case of temporary roads, the optimum spacing of roads (which is synonymous with road density) could be found where average fixed cost is equal to the average variable cost per m³ logged. So far as permanent roads are concerned the same relationship of spacing, fixed and variable costs may be applied after deciding on a write-off period for the investment.

42.7.2 However, it may be unnecessary to calculate the road spacing, where the topography would mostly dictate as to where the roads have to be located. In certain types of terrains location of the road is not at all given by the topography, e.g. in the plains part of the country. As more and more projects come to be formulated, and more expertise is built up in the planning system, the road density should be calculated on economic considerations only. But in the meantime some pre-determined standards are being built into the different projects that are being prepared. For instance, in the case of intensive forestry project for Eastern Maharashtra, the target is to achieve a road density of 0.7 km per sq km. In the case of the project for the development of undeveloped forests in North Bengal through the agency of West Bengal Forest Development Corporation, the targetted road density in the hilly terrain is about 1 km per sq km. We tried to obtain information about the inaccessible forest areas brought under use due to new construction of roads in the Fourth

Bhalla, Baldev K. & Svanqvist, Nils., 1968 (April). Optimising Logging Costs: pp 56-70, Dehra Dun. Logging Training Centres Project, Government/UNDP/FAO.

Plan period. The information for some of the States is as follows :

State	Fourth plan target for road construction (km)	Total inaccessible area brought under use (sq km)	Density of roads on the basis of additional area brought under use. (km per sq km)
Assam	177	200	0.88
Jammu & Kashmir	688	1500	0.45
Kerala	120	454	0.27
Meghalaya	60	450	0.17
Tamil Nadu	235	597	0.39
West Bengal	40	100	0.40
Andaman & Nicobar Islands	1 67	91	1.84

42.7.3 It should be remembered that there are not only deficiencies in the collection of statistics in the Forest Departments, but opening up of the inaccessible areas could be the cumulative effect of roads constructed in earlier periods and by all other departments. However, for all practical purposes for project formulation, the targets of 0.7 and 1.0 km per sq km as adopted by Maharashtra and West Bengal for opening up their inaccessible forest areas in the plains and the hills respectively should be a good guide. For indicating the national efforts needed by 2000 AD we are of the opinion that a projection can be made on weighted average of 0.75 km per sq km for the production forestry area. After considering the present average road density of about 0.20 km per sq km and the existence and future possibilities of roads under the auspices of other organisations, it should be necessary to plan for additional 0.45 km of roads per sq km of forests dedicated to production forestry, to be achieved by 2000 AD. The area of such forests is likely to be not less than 48 million ha or 480,000 sq km; the total length of roads (main roads, branch roads and feeder roads) to be constructed approximately in the next 25 years for successful implementation of production forestry programme would be about 215,000 km. The Fifth Plan target is only 15,000 km in five years, a target that ought to be achieved yearly in the nineties, if self-sufficiency in industrial wood production is to be achieved.

Inputs

42.7.4 Fertiliser : Use of fertilisers in forest plantations is gradually being taken up. In the production forestry envisaged by us, the use of chemical fertilisers for obtaining higher growth rate would be one of the standard techniques wherever necessary. Each State should create facilities for soil testing by setting up small soil laboratories under their research organisations, so that the most economic dose of fertilisers may be adopted. Research in respect of fertiliser requirement of forest crops has been carried out in the past, but it would still have to continue to find out if more economy is possible, particularly in view of the shortage of chemical fertilisers in this country. The Central forest planning organisation should undertake a review of the fertiliser requirements, current as well as prospective, and should be in close touch with the Fertiliser Division in the Union Ministry of Agriculture & Irrigation so that forestry sector can get the requirement without there being any conflict with the agriculturists' demands.

42.7.5 The information available from different States indicate the use of fertiliser in eucalypt and teak plantations. The accelerated growth due to the use of fertiliser solves the weeding problem to some extent. Particularly teak, a light demander, is greatly benefitted by the use of fertiliser, as it can cross the stage of suppression by weeds within one year by such use. The spacing of plants generally adopted is 2m × 2m in most States, e.g. Karnataka, Kerala, Maharashtra, Tamil Nadu, Madhya Pradesh, etc. In Karnataka, fertiliser (different combination of N, P and K) is used twice in the first year, once at the time of planting and again at the time of hoeing and weeding. In the second year, application of fertiliser is done only once at the time of hoeing and weeding. The soil in planting sites is generally typical of dry zone areas, red sandy loam with very little humus. In Maharashtra, fertiliser is applied in the first year only in eucalypt plantations. In areas with rainfall less than 750 mm, 30 gm of ammonium sulphate and 30 gm of superphosphate per plant is used. In areas with rainfall more than 750 mm, two and a half times the above dosage are used. In Tamil Nadu, eucalypt plantations get 75 gm of fertiliser per plant in the first year, and the same dosage in the second year. In terms of NPK, the composition of fertiliser used is 6.7:10:10. In West Bengal, fertiliser is applied to fast growing species plantations in poor red soils and lateritic soils in the south-western part. The composition, NPK (15:15:15), is generally used with two applications of 30 gm each per plant in the first year and one application of the same dose in the second year. However, the total fertiliser intake in forestry

operations is still quite negligible. With the introduction of the massive programme of production forestry we have recommended, the need for fertiliser by 2000 AD for the forestry sector may go up to 65 to 70 thousand tonnes per annum.

42.7.6 Seed: Seeds of many species that are regenerated in a region would be available locally. But it may be necessary to introduce exotics as well as autochthonous species in many localities for a much quicker growth. Tropical pines and *chir* would be a case in point. Regarding teak, many States prefer seeds of certain provenance, and an arrangement has already been devised by different States for the necessary exchange or supply of seeds.

42.7.7 Quality seeds are essential for the success of production forestry. It is understood that seed testing rules have been framed by the FRI for about 60 important tree species and a seed certification scheme evolved. These rules and the scheme should be adopted by the State Forest Departments. The State forest research organisations should also formulate, in consultation with the FRI, proper guidelines for pre-treatment of forest seeds and optimum conditions of seed storage. The State forest research organisations should carry out selection of plus trees of important species and establish seed orchards and clone multiplication plots, where necessary. In the case of seeds of exotic species, quarantine regulations should be strictly enforced. Pathogens and insect pests of forest trees are generally different from those of agricultural crops. So the forest plant quarantine rules and regulations should be formulated separately with the involvement of the FRI. It is possible that this country may be able to export or exchange seeds. Attempts should be made to have internationally standardised plant quarantine regulations for forest species, so that eventually greater reliance could be placed on pre-entry quarantine inspections.

42.7.8 Irrigation : Irrigation facilities are absolutely necessary for forest nurseries. Generally, the nurseries are temporary, and are raised near the site of plantations. Irrigation is mostly done by watering through manual labour. Temporary wells are dug in the nursery site or water from the hill stream tapped.

42.7.9 So far as plantations are concerned, irrigation is resorted to on canal side plantations in the arid areas of Punjab, Haryana, Rajasthan, Gujarat, Uttar Pradesh, etc. Irrigated plantations have also been raised in plantations along the roads or in blocks. Saraswati plantations in Haryana is an outstanding example of irrigated block plantations being raised in the country. Wasteland to the extent of about 4,000 ha in one block in the middle of the intensive farming zone

has been brought under this programme, and irrigation is being arranged from a canal. The area is divided into a number of blocks and is served by a system of feeders, irrigation being done in the trenches only. Night irrigation has been found to be relatively more efficient and effective. *Sissoo* (*Dalbergia sissoo* Roxb.) and *Eucalyptus* hybrid are the main species raised. Site suitability for different species is also judged through a criterion developed after studying the ground vegetation, soil pH, salt concentration, etc. Although canal irrigation was largely depended upon in the past, the Forest Department has started installing shallow tubewells, due to erratic water supplies and occasional closures of canals. In the irrigated areas of Punjab, Haryana and Uttar Pradesh, the species raised, apart from the above, are mulberry (*Morus alba* Linn.), siris (*Albizia lebbek* (Linn.) Benith), bakain (*Melia azedarach* Linn.), gutel (*Trewia nudiflora* Linn.), etc.

42.7.10 There is very little information on the water consumption of these species. It had been estimated¹ that the minimum depth of surface flooding necessary for good *babul* (*Acacia nilotica* (L.) Willd. ex Del.) growth varies from 5 cm in very stiff clay soils to 20 cm on most porous ones. In the experiments carried out in irrigated canal side plantations in areas which are now in Pakistan, it was found that for *sissoo* and mulberry, a 3 foot (about 1 m) delta delivered in 6" (15 cm) waterings was about the optimum limit of irrigation for average soils.

42.7.11 During the past decade or so, many river valley projects have come up and many will be coming up in the future. For future irrigation projects, we have recommended in Chapter 15 on Irrigation that the project report should be prepared in three parts, Part III containing all items pertaining to agriculture, animal husbandry, forestry, fishery, communications and cooperation. Normally raising irrigated plantations under small scattered patches will not only create difficulties in its management but also serve little purpose. The Forest Departments should identify the wasteland and marginal lands within the canal commands, and estimates of the fund and water requirement should be made for inclusion in the report for the irrigation project. A minimum of 100 ha at one place should be available for raising irrigated plantations to qualify for inclusion in the project. A study should be initiated by the Council of Forest Research and Education (CFRE), that we have recommended to be set up in our Interim Report on Forest Research and Education, on the water consumption of different species in order to minimise the expense on irrigation as well as to avoid over-irrigation.

¹ Troup, R. S., 1921. *Silviculture of Indian Trees* : Vol II, p. 422. Oxford Clarendon Press.

42.7.12 Credit : Institutional credit for production forestry programme is being organised, pursuant to our recommendations in the Interim Report on Production Forestry—Man-made Forests. So far, forest development corporations have been formed and registered in Andhra Pradesh, Bihar, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Tamil Nadu, Uttar Pradesh and West Bengal. Guidelines have been drawn up by the ARC for providing credit for forest development projects, and most of the State forest corporations are in dialogue with the ARC. The Public Investment Board, Government of India, has also cleared the plan scheme of Central participation in the State forest development corporations, and an outlay of Rs. 10 crores for the Fifth Plan has been approved. However, there are still a number of issues which are impeding the flow of credit to the forest development corporations. We had recommended in our Interim Report that there should be a planning cell under the Inspector General of Forests (IGF) headed by an Additional IGF to act as the trouble shooter for the States and get their problems solved with the Central Ministries dealing with industry, finance, banking, etc. The cell was also expected to take lead in export promotion of timber and forest products. Even though the Government of India have accepted the recommendations, the planning cell has not yet been created.

42.7.13 There has as yet been no Central assessment of the quantum of institutional credit that might be required in the forestry sector in the coming years in order that the production, export and the industrial programme envisaged could be realised. We recommend that such a study should be taken up by the planning cell at least upto the year 1985. The production forestry programmes would themselves generate a sizeable amount of internal resource by the sale of the existing crop (crop I). The taxation law provides for a levy of income tax on the entire net sale proceeds of crop I. This has the effect of taxing the capital itself, which could otherwise be employed in the forest development activities with reasonable interest adjusted in the books of the corporations. It has to be remembered that, but for the production forestry programme, this capital would have remained locked up and would not have been available to the country. Moreover, these forests cannot be allowed to be cut without being replaced. The expenditure on man-made forests for raising crop II is thus mandatory, and there is a case for amending the tax laws in such a way that reasonable deductions are allowed from the net income for creation and maintenance of the man-made forests.

8 CONTROL OF FOREST DISEASES AND INSECTS

42.8.1 Forest diseases and insects take a considerable toll of the productivity, usefulness and value derived from the forest resources, and cause damage to standing trees as well as wood in storage. Their occurrence is highly variable in time and place; they disrupt the resource management process at all levels. As the diseases and insects are the major biological detriments to forest wealth, forests should be protected from them. Studies on forest diseases and insects are being carried out by the FRI since a long time. In fact, one of the six branches with which the FRI was inaugurated in 1906 was that of Forest Zoology. The commencement of research in forest entomology, however, dates back to 1901, when a Forest Entomologist was appointed under the Government of India. The Forest Pathology Branch started at first as a Mycology Section within the Botany Branch in 1927. The Coimbatore and Bangalore centres of the FRI deal with, among other subjects, regional studies in forest entomology, mycology and sandal spikes.

Diseases¹

42.8.2 Natural forests: Heart-rots account for major losses to timber in natural forests. *Fomes caryophylli* (Racib.) Bres. *Hymenochaete rubiginosa* (Schr.) Lev. and *Fomes fastuosus* (Lev.) Cooke caused major timber losses in high and coppice sal forests. *Fomes badius* Berk. continue to cause major timber losses in *Khair* (*Acacia catechu* Willd.), the heartwood of which is prized for *cutch* and *katha* of commerce. *Fomes pini* (Thore ex Pers.) Lloyd was a major heart-rot fungus in blue pine (*Pinus wallichiana* A. B. Jackson). *Polyporus shoreae* Wakefield root-rot was responsible for large scale windthrow of *sal* in high rainfall areas of West Bengal and Assam.

42.8.3 *Cronartium himalayense* Bagchee, the stem blister rust, caused serious mortality in young plants of *chir* about 2-4 decades back. The incidence of the rust on the pine declined subsequently. *Peridermium cedri* (Barclay) Sacc. caused witches brooms in *deodar* [*Cedrus deodara* (D. Don) G. Don f.] in many localities killing affected twigs and sometimes trees. *Arceuthobium minutissimum* J. D. Hooker caused serious growth losses and mortality in blue pine in the dry zone of western inner Himalayas and in Kashmir Valley. Damage is not significant on blue pine in comparatively higher rain-

¹ Singh, Sujan. 1975. Disease Situation in India Forests. A Paper presented to the Second FAO World Technical Consultation on Forest Diseases and Insects, New Delhi.

fall areas. *Armillarea mellea* (Vahl.) Quel. causes mortality in mature and over mature trees of spruce [*Picea smithiana* (Wall.) Boiss.] and fir (*Abies pindrow* Royle). These tree species are also attacked by *Fomes annosus* (Fr.) Cooke but the damage is not significant.

42.8.4 About 50 per cent trees turn out hollow in the lower stem at the end of rotation in dry coppice teak in Gujarat. Common causal fungi were *Fomes lividus* (Kalchbr.) Sacc. and *Polyporus zonalis* Berk. Under the prevalent practice of coppicing flush with ground, callus shoots originating from cambial activity are encouraged. These shoots retain intimate connection with the stools during their growth and become decayed if the decay is present in the stools. Stem and branch disease caused by *Corticium Salmonicolor* Berk. & Br. in teak and other hardwoods is also seen in India.

42.8.5 *Ganoderma lucidum* (Leyss.) karst. has been found to cause upto 45 per cent mortality in the first nine years growth of *khair* plantations raised as reforested stands after clearfelling natural mixed deciduous forests without removing roots and stumps of the previous crop. *Ardu* (*Ailanthus excelsa* Roxb.) and *semul* raised on such sites are resistant.

42.8.6 *Sissoo* has been found to suffer high mortality due to drought in Rajasthan and water-logging during rains in *terai* areas of Uttar Pradesh. The species also suffered mortality due to wilt caused by *Fusarium solani* (Mart.) Appel & Wr. when raised on clayey soils where drainage was poor.

42.8.7 Plantations : In a *deodar* plantation, *Peniophora luna* Romell caused heart-rot in the lower trunk region in 50 per cent of the trees in a felling coupe destroying about 25 per cent of the stumpage area. *Fomes annosus* considered unimportant in natural forests in India, caused sporadic mortality in pole size *deodar* and fir in plantations in Himachal Pradesh. *Armillarea mellea* was also found associated with *F. annosus*. Exotic pathogenes like *Lophodermium pinastri* (Schr.) Chev. and *Dothistroma pini* Hulbary were recorded on indigenous *chir* pine and blue pine, but damage was negligible as both pines are resistant. *Cercospora pini-densiflorae* Hori et Nambu caused 50 to 80 per cent mortality in *Pinus radiata* D. Don. *P. pinaster* Aiton and *P. halepensis* Miller seedlings in nurseries in New Forest, Dehra Dun.

42.8.8 Wilt of *Casuarina equisetifolia* Forst. due to *Trichosporium vesiculosum* Butler common in South India was also recorded from Gujarat in the west and West Bengal in the east. The pathogen enters through injuries caused to any part of the plant. *Cylindrocleftidium scoparium* Morg. and *C. quinqueseptatum* Boed. & Reitsma caused 50 to 95 per cent mortality in the first year growth of *Eucalyptus*.

tereticornis Sm. and *E. grandis* (Hill.) Maiden in field plantings in high rainfall areas of Goa and Kerala. *E. torelliana* F. v. M. and *E. degrupta* Blume were comparatively resistant.

42.8.9 Pink disease caused by *Corticium salmonicolor* has caused considerable concern in *Eucalyptus tereticornis*, *E. grandis* and *E. citriodora* Hook. plantations in high rainfall areas of Kerala, Karnataka and Goa. The mortality may go upto cent percent in worst affected plantations. In areas with rainfall below 200 cm, attack of the disease on eucalyptus has been found to be common but the cankers remain localised and the plants continue to live. Eucalyptus also suffered from root rot due to *Ganoderma lucidum* resulting in windthrow in plantations raised as reforested stands. *Eucalyptus tereticornis* suffered yellowing, dieback, premature defoliation and eventually death of affected plants in *terai* areas of Uttar Pradesh. The cause is yet to be known.

42.8.10 Poplars are confined only to test plantings except in *terai* areas of Uttar Pradesh. Bark bursts on *Populus deltoides* Marshall and *P. X euramericana* (Dode) Guinier cv. 'casale' were common on sites with high water table. The affected bark was usually attacked by *Botryodiplodia palmarum* (Cooke) Petrak & Syd. causing cankers which were usually healed over during next year's growth.

42.8.11 Exotic confers are also in test planting stage excepting *Pinus Patula* Schiede & Deppe and *Cryptomeria japonica* in North Bengal and *P. patula* and a few other species in Tamil Nadu *P. radiata* suffered seriously in Tamil Nadu from *Dothistroma pini* attack. *Diplodia pinea* (Desm.) Kickx and *Lophodermium pinastri* have moved along with pines throughout India and damage is serious at present. *Cronartium himalayense* attacked *Pinus canariensis* C. Smith seedlings in a test planting in Ranikhet (Uttar Pradesh). *Cupressus arizonica* Greene, *C. lusitanica* Mill. *C. macrocarpa* Hartweg, *Juniperus procera* Hochst were badly damaged by *Monochaetia unicornis* (Cooke & Ell.) Sacc. in test plantings New Forest, Dehra Dun. *Armillarea mellea* caused root rot mortality in 50 year old *Cryptomeria japonica* plants in North Bengal.

42.8.12 Diseases in timber in storage: Timber in storage is also susceptible to different diseases caused by micro-organism. Wood formation is associated with production of sugar, starch, cellulose and other food material as a result of reaction between carbon dioxide and water in presence of chlorophyll and activated by sunlight, i.e. photosynthesis. In a broad sense wood substance consists roughly of cellulose 60 per cent, lignin 30 per cent and sugar and other extractives 10 per cent. Thus it will be seen that wood forms a food material for insects including termites and marine organisms and

fungi including soft rot. The deterioration of wood takes place the moment a tree is felled and continues throughout its subsequent utilisation, that is in storage and use. However, there are some woods with a high density and those containing extractives in the heartwood toxic to wood destroying agencies or repellant to the same. These are called naturally durable woods and may contain alkaloids, phenols, essential oils, quinones, silica, etc. But they hardly account for 10 per cent of total wood volume used for industrial purposes.

42.8.13 It has been estimated that more than 10 per cent of the wood in use has to be replaced annually due to biological degradation and even higher amount deteriorates during transport and storage, not taking into account the losses to the standing tree caused by fungal and insect damages. It is a safe estimation that about one-third of the timber produced is continuously lost due to biological degradation¹. Proper inventory of losses due to biological degradation in this country has not been made so far. Tremendous economic losses and their impact on the increasing demand for timber are obvious. It has to be emphasised, however, that wood preservation plays a significant role in any timber marketing and utilisation. Wood preservation which means the prevention of damage by organisms cannot be achieved solely through the application of toxicants. It has to start at the beginning of the timber exploitation, taking into consideration the physiological requirements of the attacking organisms. Preservative treatment is a must in tropical countries particularly when resources are limited, deterioration and demands are high, as it helps in the conservation of the forests by prolonging the life of timber both in storage and in use. In some countries imparting prophylactic treatment before the timber leaves the forest area is mandatory under legislation; in some others, even the full-fledged treatment before use of non-durable timbers is also mandatory. Also, the establishment and maintenance of timber yards under hygienic conditions is also mandatory.

Insects

42.8.14 Besides the diseases enumerated above, the standing trees in the forests as well as the felled timber in storage are attacked by a number of insects. The pests are either leaf eating insects or borers of stem, root, shoots of the standing trees as well as felled trees. The common leaf eating insects are *Calopepla leayana* Latreille. *Epilachna* sp., *Apoderus sissoo* Marshall, teak defoliators (*pyrausta*

¹Liese, W., 1975. Biological Deterioration of Wood in Storage and Use. A paper presented to the Second FAO World Consultation on Forest Diseases and Insects, New Delhi.

machaeralis Walker, *Hyblaea puera* Cramer), locusts and grasshoppers, *Ectopis deodarae* Prout and *Plecoptera reflexa* Guenee. The nursery pests are cockchafer (Coleoptera : Melonlonthinae), Cutworms (Lepidoptera, Noctuidae), crickets (Orthoptera, Gryllidae), defoliators, sapsuckers and termites. A few important insects are discussed in the next few paragraphs.

42.8.15 *Sal* heartwood borer (*Hoplocerambyx spinicornis* Newman) is the scourge of *sal* forests. Recurrent epidemics of *sal* borer cause catastrophic losses. In case of teak periodic outbreaks of the defoliators cause considerable loss of increment and quality. There are about 14 to 15 overlapping generations of the pests per year. This causes not only problems for studying the population dynamics of the pests but also problems of chemical control as all stages of pest are available at all times.

42.8.16 A shoot borer (*Tonica niviferana* Walker) is a serious pest of *semul* plantations. It oviposits on the terminal bud, the egg hatches and the larva bores in at a leaf's axil, and eats its way downwards. Shoot may be completely hollowed out. After 5 or 6 larvae instarts, the larva comes out of the stem and pupates are exposed. The attack on shoot of the young plants causes death of the plant. It is replaced by side shoots from auxillary buds. Those shoots may again be killed by fresh attack. There are 5 to 6 overlapping generations in a year. If the same plants are attacked again and again there is little chance for the young plants to survive and the plantations are abandoned as it happened in Bihar in the early fifties and sixties.

42.8.17 *Hypsipyla robusta* Moore is the most important pest of Meliaceae within its range and causes considerable loss of seed, particularly of *toon* (*Cedrela* spp). But its importance lies mainly in its activity as shoot borer and infestation is heaviest on young trees growing in full sun. Heavy infestation with repeated destruction of the terminal buds results in forking, development of crooked stems and often in permanent stunting. It is also a major pest of *Swietenia*. There are 5 generations in a year. First generation feeds on flowers; second on fruits and third to fifth generations on shoots. The duration of fifth generation is lengthened under winter conditions.

42.8.18 *Calopepla leayana* is a serious pest of plantation of *gambhar* (*Gmelina arborea* Roxb.) in Assam and Tripura. In heavy infestation the leading shoots of young trees dry up and plants remain leafless for about 4 months of the growing season and are eventually killed. Defoliation commences in the beginning of the rains and continues till October. The pest hibernates and aestivates in adult stage for a total period of 8 months. The beetles hide in cracks and holes under the dead bark of standing trees, in hollow bamboos and dry leaves on the ground.

42.8.19 Nearly 70 insect species feed on eucalyptus but except termites and *babul* stem and root borer which cause large scale mortality in certain regions, all others are casual feeders. In recent years the *babul* borer primarily a pest of *Acacia* has taken a fancy for eucalyptus. Adults feed upon green bark, sometimes completely girdling growing shoots and killing them. Oviposition takes place on the bark of the young plant. Egg hatches and larvae enters the stem eating its way out into the root and killing the plant. Life cycle is annual. Plants of higher girth are not suitable for oviposition and hence older plantations are not attacked.

Control Measures

42.8.20 A majority of forest diseases and insects in respect of important economic forest tree species have been identified and recorded in numerous publications. Comprehensive accounts and details of diseases and quantification of losses due to them were submitted to International Union of Forest Research Organisations (IUFRO) Congress.* As more emphasis is now being given to the utilisation of secondary species, the programme of identification of diseases and insects should be enlarged. Check lists should be prepared of forest insects and disease-causing organisms giving their geographical distribution as well.

42.8.21 In view of the great demand for economically important timber, secondary species and less valuable timber should be used for domestic requirements after seasoning and chemical treatment. The economically important, and very often naturally durable, timber may be kept for the purpose of export so as to earn more foreign exchange. The Government Departments such as Central Public Works Department, State Public Works Departments, etc. using timber for departmental work should give more importance to the use of seasoned and treated secondary timber.

42.8.22 Before deciding upon any control measures, the impact of the disease or insect attack should be evaluated, if possible, by techniques of cost-benefit analysis, and the feasibility and the magnitude of control measures, if the latter are found necessary, should be worked out. It has been seen that most of the insects occur in a certain period of the year and in certain places only in one stage of growth, during which the density of population can be assessed. This makes the framing of a set pattern of control at specific times easy. Collection of comparative data about the fluctuations in the intensity of insects and pests for research is also facilitated. It would

*XIII and XIV Sessions held in 1963 and 1967 respectively.

be necessary to collect basic data on the biological cycle of the pest- or disease-provoking agents, their manner of propagation and ecological requirements, as well as data on the susceptibility of host plants, etc. The control measures would broadly be : (a) biological and silvicultural, (b) chemical, (c) integrated management and (d) quarantine.

42.8.23 Although there are numerous reports on biological control for diseases in agriculture, the number in forestry is relatively small and limited almost entirely to biological control of diseases in nurseries and plantations. It is possible to apply some of the practices that have achieved a degree of success in agriculture, such as inoculations of soil, plant surfaces or vascular tissue with competitive or antagonistic micro-organisms and modification of soil conditions by physical and chemical means so that tree growth and natural biological control by soil microflora are enhanced and the development of pathogens discouraged. Use of predators and parasites as an important tool of biological control has long been practised in this country.

42.8.24 Silvicultural measures include consideration of a number of factors, such as identification of sites in man-made forestry projects, choice of species, seed quality, timely thinnings, removal of dead and diseased trees, etc. concentrated fellings leave a large number of stumps and felling slash. Felling debris should be carefully burned, so that the chances of spread of disease is minimised. Working plans for coniferous areas prescribe such operations as a 'must'. In the tropical dry deciduous forests also, it should be so. Heart-rots in *sal* and teak over large areas in these forests have originated from the breeding of the disease in felling slash. Dense pure regenerated crops, like *sal* and teak, should also be thinned according to the silviculture of the crop. Very often thinning is delayed or postponed due to the paucity of funds, and the importance of thinning in protection from diseases and pests, apart from augmenting growth, is not properly appreciated. *Sal* heartwood borer attack is found to be heavier in unthinned crops. Genetic control should also be resorted to by breeding strains immune or less prone to known injurious organisms. A priority should be given to explore the natural genetic variability in tree species, properly documenting the individual's resistance to disease and insect pest and to follow up action on the findings.

42.8.25 Chemical control should be used after careful consideration of the effect of chemicals on non-target organisms, which may include the predators or parasites of the target organism and many others useful to man. Chemical control is extensively used in case of teak defoliators or against termites in eucalypt plantations. It is to be remembered, however, many chemicals are broad-spectrum killers. Some of the chemicals, e.g. chlorinated hydrocarbons, are non-biodegradable or degrade extremely slowly. Through various food and

water chains they find their way inside the systems of men, birds, fishes and other useful animals.

42.8.26 In the past pesticides derived from toxic chemicals have been used in the control measures, particularly in the developed countries. In the developing countries they have so far been mainly used for agricultural crops. But their use in the forestry sector is likely to go up in view of large scale plantation activity. The usefulness of pesticides is unquestioned but their extensive use has brought into focus harmful side-effects on the quality of environment. These side-effects arise from killing of or injury to non-target organisms, and cumulation of pesticides inside organisms or systems. Full consideration should be given to these side-effects before taking up control measures in the event of an outbreak of disease or insect attack on an epidemic scale.

42.8.27 In the developed countries the ill-effects of pesticide application have led to further research for discovering safe control measures for containing the disease and insect attacks. The discovery of the harmful effects of chlorinated hydrocarbons led to the development of organophosphatic pesticides, which were found less harmful from the environmental point of view. These in their turn have begun to be replaced by a still safer class of pesticides, i.e. the carbamates. The present tendency is to replace persistent broad-spectrum toxic pesticides with less persistent, less biodegradable selective pesticides. The optimal dosages and the application technology have also undergone considerable changes. Higher concentration, smaller dosages and spraying in the form of minute droplets have tended to reduce the pollution from pesticides, while achieving nearly the same efficacy against the target organisms. Any application of control measures by toxic chemicals should be made after considering the effect of the pesticide use on environmental quality.

42.8.28 Integrated management of forest pests, involving an appropriate admixture of genetic, biological, silvicultural and chemical approaches, aims at minimising losses by pests and reducing environmental degradation, but maximising socio-economic profits of the resources. Its general guidelines are to define the role of forest insects and diseases in relation to the particular objectives of forest management. Biological damage should be determined by relying upon an adequate measurement of the pest population, fluctuations over time by continuous population monitoring, etc. The population sampling should be done in the context of population dynamics such as determining those factors which regulate population fluctuations within the prescribed ecosystem. For integrated pest management to succeed, the ecology of the system must be as thoroughly understood as possible.

42.8.29 One objective of integrated pest management is to avoid environmental degradation. Integrated control purports to achieve this objective by : (a) protecting and augmenting natural enemy action, (b) altering the environment to make it unsuitable for the pest. Utilisation of natural enemies of pests through biological control deserves a key position in integrated control.

42.8.30 Hazards of introduction of foreign pests and diseases through bulk imports need hardly any emphasis. Seeds of numerous forest plants are imported in large quantities by various Forest Departments from all over the world with or without phytosanitary certificates and additional certification of field inspection before export. Since 1967, the consignments are being fumigated and treated with copper based fungicides before release. The plants raised from imported seeds are not being subjected to regular inspection. Even diseases hitherto unknown in this country but which caused havoc in other countries have been introduced. *Cronartium ribicola* J. C. Fisch. causing serious damage in Europe and USA on 5 needle white pine had been reported in India in Jammu & Kashmir on 5 needle blue pine.¹ *Cercospora* blight (*Cercospora pini-densiflorae*) is reported to cause 50 to 80 per cent mortality in nurseries and has been recorded on exotic *Pinus radiata* in Madhya Pradesh; *Diplodia pinea* and *Lophodermium pinastri* have also been recorded on exotic *P. patula* and *P. elliotii* Engelm. Dothistroma blight of radiata pines causes defoliation under humid conditions leading to death of the plants. This disease caused serious losses to radiata plantations in Tamil Nadu and indigenous 5 needle and 3 needle pines in Jammu & Kashmir and Uttar Pradesh. Monochaetia canker (*Monochaetia unicornis*) causing oozing cankers and die-back has been recorded on exotic cypresses and junipers.

42.8.31 A list of quarantine procedures and regulations affecting trees, seeds, seedlings and wood products should be compiled, with a view to encouraging standardisation of plant quarantine regulation among countries leading eventually to greater reliance being placed on pre-entry quarantine inspections in the country of origin when such inspections are based on approved procedure. There should be regular post-entry quarantine inspections on all nurseries and plantations raised on imported seeds. The pathogens and insect pests of forest trees are generally different from those of agricultural crops. The forest plant quarantine should possess a distinct entity though remaining within the general framework of plant quarantine. As some of the diseases and insect pests have wide ranges of distribution that cross

¹ Banerjee, S. N., 1975. Plant Quarantine in India. A paper presented to the Second FAO World Technical Consultation on Forest Diseases and Insects, New Delhi.

international boundaries and can only be controlled by international cooperation, a coordinated research and control programme should be drawn up through international cooperation.

42.8.32 The increased danger from diseases and insect pests in man-made forests stems from two causes. Firstly, the indigenous pests and pathogens may become important on exotic tree species, though may remain latent in the natural forests. Secondly, pests and pathogens introduced inadvertently may become serious threats. As examples of the first danger, amongst fungi, *Diplodia pinea* causing twig blight of Mexican pines and *Lophodermium pinastri* causing premature needle cast in *Pinus elliottii* and *P. patula* may be quoted. The recent discovery of *Corticium salmonicolor* attack on *Eucalyptus* spp in Kerala and elsewhere in the country and the vulnerability of *Pinus canariensis* to *Cronarrium himalayense* are pointers to the danger from the second cause. Amongst insects *Celosterna scabrator* Fabricius, primarily a root and shoot borer of *Acacia* spp, has become a serious pest in some *Eucalyptus* plantations. *Apriona cineria* Chevrolat, a pest of apple trees and *Morus alba* has affected exotic poplars¹. These eventualities should be considered and provided for before undertaking plantation programme.

9 SOCIAL FORESTRY

42.9.1 In the past, farm forestry was adopted as a means of creating new wood resources and replacement of wood harvests in farm lands, community lands, etc. Farm forestry is defined as the "practice of forestry in all its aspects on farms or village lands, generally integrated with other farm operations". However, what was actually practised might possibly be better termed as extension forestry (with farm forestry as its integral part). It included the activity of raising trees on farm lands, village wastelands and community forest areas, and on lands along the sides of roads, canal banks and railway lines. But farm forestry (or extension forestry) has not made any uniform progress in all the States. Even where it did, the practice did not stem entirely from the concept of producing from the forests or treelands a flow of physical benefits and social values. It is in this context that we submitted the Interim Report on Social Forestry.*

¹ Sen Sarma, P. K., 1972. Insect factors in management of man-made forests. Symposium on Man-made Forests in India, Dehra Dun, June 8-10.

* Hereafter referred to as Interim Report in this section.

42.9.2 In the Interim Report, the Commission stressed the socio-economic importance of social forestry in the rural community as well as in the management of forest resources. It was stated that by taking up the programme of raising of trees, grasses and fodder in the farmers' own lands, village commons, wastelands and degraded forests close to habitations, it would be possible to meet the requirement of fuelwood, fodder, small timber for rural housing and agricultural implements, thorns, for fencing, etc. It was also stated that at the same time these programmes would remove a serious impediment in the practice of production forestry. We adopted the following as the objectives of social forestry, being the basic and economic needs of the community aimed at bettering the conditions of living :

- (i) fuelwood supply to the rural areas and replacement of cow-dung;
- (ii) small timber supply;
- (iii) fodder supply;
- (iv) protection of agricultural fields against wind; and
- (v) recreational needs.

Accordingly the scope of the social forestry programme was defined by us to include farm forestry, extension forestry, reforestation in degraded forests and recreation forestry. In the following few paragraphs we highlight the important recommendations made earlier, pointing out also, wherever relevant, any new situation.

Farm Forestry

42.9.3 The basic component of the operations would be to organise a substantial programme of planting of trees on bunds and boundaries of the fields of the farmers, to be taken up by the farmers themselves. Even though the idea of *vanamahotsava* and farm forestry had been accepted in the planned development, it has not caught on with the farmers except in a few pockets of the country. The crux of the matter is motivating the farmers to take to this practice. This cannot come about merely by precept and by lecturing to the farmers about the important role of the trees in their life and the imperative need for them. The farmers themselves till take to it on a large scale, provided the necessary organisation of the State is created to assist and guide them, and it is demonstrated to them that an economic return from the practice is possible without its having any adverse effect on crop yields.

42.9.4 We recommended in the Interim Report that a pilot scheme should be taken up for setting up central nurseries by the Forest Departments covering 100 selected districts in the Fifth Plan. The extension organisation as recommended in the Interim Report should

remain particularly vigilant (the forestry personnel to man such organisations should be specifically chosen) in order that the advantages of the programme and the methods of tree plantations are widely propagated.

42.9.5 Recently the value of trees standing on farms were brought under the purview of the Wealth Tax Act. To the farmers imposition of wealth tax on tree growth was proving a great disincentive to the programme of farm forestry. In the context of present energy crisis and fuel shortage, the farm forestry programme would go a long way in providing the much needed cooking fuel, small timber and leaf fodder to the farmers, in addition to helping in increasing the productivity of the farms. The pressure on the already over-burdened transport system for carriage of coal from distant places to States like Punjab and Haryana would also ease. The farmers have therefore to be provided with incentives so that they take to planting trees on the farms. In advanced countries like the UK and USA special incentives are given to the farmers in the form of exemption of woodlands from estate duty, wealth tax, etc. to encourage them to take to tree planting. In the Budget for 1975-76, with a view to preventing indiscriminate felling of trees, a provision has been made in the Wealth Tax Act exempting the value of trees standing on agricultural land (not being trees in any orchard or plantation) from wealth tax. We welcome this approach and we recommend that this should form a permanent provision in the Wealth Tax Act.

Extension Forestry

42.9.6 Extension forestry, as envisaged for the purpose of the social forestry programme is to cover : (a) mixed forestry on wastelands, *panchayat* lands, village commons; (b) raising of shelter-belts in dry and arid regions; and (c) raising of plantations of different quick growing species on lands on the sides of roads, canal banks and railway lines.

42.9.7 We suggested the following important steps in the matter of mixed forestry in our Interim Report :

- (i) any programme of mixed forestry in the village wastelands and *panchayat* lands should be such as is acceptable to the village population;
- (ii) the programme should be undertaken only in such areas where the incidence of waste lands in a village or a group of villages is sufficiently high, so that a part of it can always be kept apart for the satisfaction of the rights of villagers;
- (iii) the programme should take into consideration the need for a quick yield of such products as are the villagers' imme-

mediate concern; as such, fodder and grass should be an important component of mixed forestry to be taken up with optimum input and technology; and

- (iv) income from mixed forestry should be divided equally between the *panchayats* and State Governments. In addition in the disposal of the produce from these forests there should be an element of preferential treatment including price preference to the villagers.

42.9.8 We recommended in the same Report following steps to be taken in the implementation of the shelter-belts programme :

- (i) coordinated effort of the Agriculture and Forest Departments of the State Governments should be made for the planning and creation of shelter-belts;
- (ii) where establishment of shelter-belts is an immediate necessity, the Government should draw up the plans for their creation, acquire the necessary land and hand it over to the Forest Departments for planting and maintenance operation;
- (iii) it is imperative that research should be carried out on priority basis by the concerned institutions to determine the regions where shelter-belts should be planted, their effect on the hydrology and crop yield and their composition, management and related aspects; and
- (iv) there should be an element of subsidy, to be shared between the Central and State Governments, that has to be built into the shelter-belts programme during the first round of 15-20 years.

42.9.9 The strips of land on the sides of roads, canals, distributaries and railway tracks are not put to any productive use in most of the States. In the prevailing conditions of increasing demand for forest produce and shrinking forest areas, such strips assume a very great importance and should be planted with tree species. This programme should be treated as a commercial investment to be met by the States from their own resources or by loans from institutional financing agencies. Regarding lands on the sides of railway lines, we had particularly suggested that the Railways might be approached for handing over such lands for afforestation on suitable conditions, as is the practice in Haryana at present, or the Railways themselves might take up the plantations from their own resources.

Reforestation in Degraded Forests

42.9.10 The strategy outlined by us in the Interim Report was, first of all, to integrate the selection of degraded forests for reforestation with the survey of wastelands for planning mixed forestry.

Where sufficient extent of degraded forests exists within a reasonable distance of the rural and semi-urban complex, reforestation programme could then be taken up, and such forests linked up for supply of fuelwood and small timber at fair rates to the villagers in the complex.

42.9.11 The relevance of this programme in controlling pilferage from, and encroachments on, the forests has been elaborated in Chapter 45 on Forest Protection and Law and in the Interim Report. In the Interim Report we said that a good deal of pilferage from the degraded forests arises out of the need for some amount of profitable employment to the partially unemployed in the rural areas. A programme of clearing and planting the degraded forests would itself give employment to a large number of people. With proper planning, it should be possible to provide employment to these people all the year round. We had said that the Forest Departments must select and employ those people who are now in the habit of pilfering the timber from these areas. We referred to an interesting experiment recently undertaken in the Midnapore district of West Bengal under the Crash Scheme for Rural Employment. The objective of the experiment was to employ on various forestry operations the local unemployed and underemployed persons in a forest where pilfering of timber and fuelwood was heavy. It was understood that this experiment worked satisfactorily. The example of Midnapore deserves to be emulated with local adaptation in other States.

42.9.12 Since agri-silviculture is an accepted forest plantation technique, adoption of this practice in the reforestation programme would provide employment to many a landless labourer and simultaneously increase production of grasses and fodder and arable crops, like sunflower etc., which this country badly needs. It is needless to caution that the primary object is to keep the land under forestry, and as such the practice of agri-silviculture should be adopted only where this primary object can be enforced without difficulty.

Recreation Forestry

42.9.13 The demand for recreational centres for the urban population is increasing day by day. Most of the country's urban locations are congested, without much open space and parks. This reduces the scope for improving the quality of life in the cities. Recreation forestry can contribute both towards social development and education in environmental matters. If small blocks of forests close to urban centres are dedicated for recreation and tree groves created for picnic corners, etc., the urban people will readily make use of these areas. There are other ramifications of recreation in forest areas—in

national parks, wildlife sanctuaries, wildlife reserves etc. — and we have dealt with those aspects in Chapter 44 on Forest Ecology and Wildlife Management.

42.9.14 In the Interim Report, we recommended that each State Government should make a study of the problems of the recreational needs of the urban areas, and dedicate some forests or establish tree groves near such areas for recreational purposes. Green belts around towns and cities, where necessary, should also be created. A beginning should be made in the Fifth Plan, and each State might select the towns and cities and the sites to be taken up under the programme and formulate its own project.

Organisation

42.9.15 Instances are known where social programmes have failed for no other reason than operational incompetence, even though adequate finances were available. The implementation of social programmes demands tact, resourcefulness, perseverance, sympathetic attitude and above all a lot of tolerance. Hence, the personnel to man the organisation should be carefully selected and brought under a forestry extension organisation to be created at the Centre as well as in the States. This extension organisation should be entrusted with the responsibility for implementation of the programme of social forestry.

42.9.16 It may be pertinent to recall the recommendations of the Royal Commission on Agriculture (RCA), 1928. The RCA suggested that in each province, the Government should aim at establishing two divisions within the Forest Departments, the officers in one division to be responsible for the charge of forests, the preservation of which was desirable on climatic or physical grounds, and of commercial forests; the other division to be in charge of minor forests, fuel plantations, village woodlands and wastelands. The RCA thought it likely that, within the vast areas classed as "culturable waste" and "land not available for cultivation", there could be found much land which, though unsuited for commercial afforestation, might, "if placed under the charge of a minor forests division, be used to grow fuel and provide better grazing than it now does, or might be added to the village forests managed by *panchayats*". The RCA also suggested that "officers of the Forest Department possessed of the tact and enthusiasm, which are so essential as technical knowledge to the success of the schemes we have in view, should be seconded from the regular line of that Department to undertake this work".

42.9.17 We had recommended in the Interim Report that training in extension methodology and technology should be imparted to

selected officers engaged, or to be engaged, in implementing the programme, at various agricultural universities and research institutes where a department of extension exists or by starting an extension branch at the FRI. We had also said that the agricultural universities should include in their syllabi a course in social forestry for the agricultural graduates.

42.9.18 We had suggested the involvement of the three basic village institutions, namely local *panchayats*, cooperatives and village school staff, in the field demonstration. The extension organisation would also have to work closely with Agriculture Departments and village *panchayats* in the implementation of mixed forestry programme in the manner suggested above.

10 ROLE OF FORESTS IN SOIL AND WATER CONSERVATION

42.10.1 The importance of the forests in modifying the hydrology of watersheds and in soil conservation has been well recognised. The forest influence, whatever its magnitude, is expressed by the manner in which the forest receives, stores and releases potential flood-producing rainfall. The hydrologic processes that govern disposition of precipitation, and hence affects erosion of soil, are : (a) interception by the canopy or other tree parts, (b) reduction of velocity of surface flow due to forest litter, decomposed organic matter, mass of roots, etc., thus increasing infiltration and percolation, and (c) moderation of peak flows.

42.10.2 In Chapter 41 on Forest Policy, we have mentioned that the protective influence of forests in localities vulnerable to erosion and degradation should be brought to bear in full by suitably managing the existing forests and providing for their rehabilitation. This would ultimately lead to the maintenance of water balance, control of erosion, prevention of rapid silting of reservoirs and moderation of floods. An integrated look into the problems of soil and water conservation has been taken by us in Chapter 18 on Soil and Moisture Conservation. It becomes imperative to know the watersheds in their entirety so that proper management can be practised to maintain the water yield unimpaired and to plan for optimum land-use and sustained productivity. We have mentioned therein that the concept of soil conservation has broadened with time to meet the requirement of efficient and productive use of land. The emphasis, therefore, requires to be laid on soil and crop management on a watershed basis.

42.10.3 It has been generally recognised that in the hilly areas the genesis of soil and water erosion problems usually lies in either the indiscriminate felling of trees or in the overgrazing of pasture-

lands. Soil erosion in the catchment areas of rivers also contributes significantly to a rise in their bed levels in the plains. This in turn results in the overflowing of rivers during periods of heavy rain. The rate of siltation in the dams goes higher than expected. The desert and semi-desert areas in the plains are very much affected by soil erosion. The loss of vegetative cover in such areas as a result of indiscriminate overgrazing by migratory herds of camels, cattle, sheep and goats has exposed top soil to erosion by strong winds. The ravines which exist along the banks of some rivers, particularly in Uttar Pradesh, Madhya Pradesh, Rajasthan and Gujarat, are also caused by the erosion of soil, very often as a result of the felling of forests and overgrazing. Waterlogging and salinity are other examples of bad soil and water management. Some soil types are naturally vulnerable to erosion. For instance, in laterite and lateritic soils even the forests have to be managed with care to prevent conditions for creation of soil erosion problems. The coastal saline areas are liable to wind erosion, thereby causing degradation in inland areas too. "Barren and unculturable lands" constitute probably the most severely eroded areas. The magnitudes of "culturable lands" and "fallow lands other than current fallows" indicate neglected land management. These areas are liable to erosion. The areas categorised as "permanent pastures and other grazing lands" covering about 13 million ha perhaps represent, fallaciously though, some of the worst eroded areas. Whether it is the pasture lands of the desert or of the high hills, they are characterised by unchecked misuse. Grazing is by and large unrestricted and widely practised in forest areas, the livestock feeding on undergrowth and trespassing into the young regenerated areas. This type of indiscriminate grazing reduces the capacity of forests to conserve soil and moisture.

42.10.4 We have discussed in some detail in Chapters 17 on Land Reclamation and Development and 18 on Soil and Moisture Conservation the methods to be adopted for improved integrated management of the different categories of lands discussed in the previous paragraph, with a view to bringing them into productive use and to maintaining them in such a way that soil and water conservation problems are minimised. In this section, we highlight the different programmes that should be taken up under forest management in some of the vulnerable areas.

Catchments of River Valley Projects

42.10.5 Since forest lands occupy a large proportion of the river valley catchments and exercise material influence upon soil stabilisation and stream flow characteristics of the watersheds, the condition,

management and improvement of forest lands should, as a matter of rule, be a concern of the watershed management programme.

42.10.6 During the period of four five year plans and a number of annual plans 11.06 thousand sq km of catchment area could be treated against an estimated 1.5 million sq km covering 59 major projects. From a study of aerial photographs covering 0.2 million sq km in the catchment of 21 river valley projects under the Centrally sponsored programmes, it is estimated that the areas requiring soil conservation measures in the different catchments vary from 11 to 39 per cent. Even if only the high silt producing areas in the catchments are taken into consideration, the overall achievement has not been more than 10 per cent. A perusal of the existing land-use conditions of 11 major projects in India reveals that not more than 20 to 25 per cent of the watershed areas are covered with forests. The importance of having well protected reserved forests in the conservation of soil is exemplified in a few reservoirs in the country, which have sustained for long periods—even upto an estimated 500 years—in Central India, where the catchments are very stable due to the occurrence of forests. Our analysis of the area treated under the Centrally sponsored scheme for soil conservation in the watersheds of river valley projects shows that in the 13 river valley projects* started prior to the Fourth Plan, 333.30 thousand ha of forest area have been treated upto 1971-72, which constitute only 1.5 per cent of the total area of 22.1 million ha of catchment areas in these projects. In some of the river catchments, like that of the Mahanadi, Chambal or Ramganga, which have attracted attention in recent years by causing widespread floods, the total forest area treated adds to only 0.5 to 0.8 per cent of the total area of the catchments. In the case of the 8 river valley projects started in the Fourth Plan, no works were taken up in five of them (Nagarjunasagar, Nizamsagar, Pochampad, Beas Project Unit II and Ukai) till 1971-72. In Mahi stage II (Kadana), Lower Bhawani and Matatilla, total forest area treated was only 8,800 ha against a total catchment area of 10.81 million ha. By all accounts this is an unimpressive performance.

42.10.7 Considering the limited forest area available in catchment areas of river valley projects, it is necessary that particular attention should be paid to the degraded forest lands, which should be brought back to proper condition through reforestation wherever necessary. As recommended in our Interim Report on Social Forestry, the reforestation in degraded forest areas of the catchments should be plan-

* The river valley projects are Machkund, Mahanadi (Hirakud), Chambal, Sutlej (Bhakra-Nangal), Mayurakshi, Kangsabati, Tungabhadra, Kundah, Dantiwada, Pohru, Ramganga, Dhod and Damodar Valley.

ned for improving fuelwood and small timber supply to the villages and semi-urban areas, and this programme would reduce one of the adverse biotic factors affecting forests, namely unrestricted and often surreptitious collection and use of forest produce under the cover of extensive rights and privileges. There are a number of other biotic factors such as grazing, fire, lopping, shifting cultivation, litter removal, etc., which are operative in catchment areas affecting the hydrological processes under different forest conditions in the catchments. These are often the results of the presence of extensive rights and privileges of the villagers. Our recommendations made with respect to forest grazing, shifting cultivation, rights and privileges, protection from fire, etc. made in Sections 11 and 12 of this chapter and in Chapter 45 on Forest Protection and Law have been made not only with a view to tackling these problems but also with an eye to the important role that the forests play in conserving soil and moisture.

42.10.8 So far as the forest areas in the catchments are concerned, it is not only the areas that are liable to erosion that should be treated, but all the remaining forest areas should also be brought under proper management. In production forestry, clearfelling would have to be resorted to on quite an extensive scale. Effect of clearfelling on the hydrological conditions of the forests has not been studied in much detail in India. In a study in the US¹ it has been found that infiltration is reduced by forest cutting only to the extent that forest soil is disturbed and compacted. No appreciable surface flow was observed other than from extraction roads. Continued high infiltration rates after clearfelling, with virtual absence of surface flow, have also been observed on experimental watersheds at the Coweeta Hydrologic Laboratory. Clearfelling without serious disturbance of the forest floor does not materially reduce infiltration rates. Provided only a small proportion of the watershed is felled at any one time, increases in peak flow and flood run-off will not be large enough to be important. For instance, it was found that 10 per cent of a major forest watershed in various stages of growth after clearfelling under even-aged management might produce 10 per cent more unit-area discharge. Given a rainfall that would produce, say, 10 cm of run-off from the unfelled area, the increase in run-off from the areas as a whole would be 1 per cent, from 10.0 to 10.1 cm. The likelihood that these increases will become synchronised to augment the flood peak is indeed remote, because these increases are derived

¹ Lull, Haward W. & Reinhart, Kenneth G., 1972. Forests and Floods in the Eastern United States : pp 34-40, 36. USDA Forest Service Research Paper NE-226. North Eastern Forest Experiment Station, Upper Darby, PA. Forest Service, US Department of Agriculture.

from various parts of the watershed. In general, some of the conclusions of the study are : (a) the forest is the best of all possible natural cover for reducing peak flow and erosion, (b) with reasonable care, the forest can be cut with little detriment to its site-protective capability, (c) under sustained yield programme of forest management and with the great diversity in age classes, the extent of forest cutting offers no flood threat, and (d) the flood reduction role of the forest can be realised through continued fire protection and careful logging, and can be enhanced by reforestation of abandoned land.

42.10.9 In addition to the above conclusions, with which we are in agreement, it is necessary to ensure that in forests in catchment areas unrestricted grazing is not allowed. In order to get the full benefit from forest management in catchment areas, our recommendations with respect to forest grazing, shifting cultivation and forest protection should be rigorously pursued. The degraded lands outside the forest areas should be brought under social forestry, either for plantation of quick growing fuel species or by developing grasslands and grass reserves. The development of grasslands and grass reserves should particularly be linked up with programme of improvement in livestock in order to make both the soil and moisture conservation and the livestock development programmes economical ventures.

Ravine Lands

42.10.10 Extensive degradation of land along the banks of the Yamuna, the Chambal, the Mahi, the Sabarmati and their tributaries has affected a very large expanse of land areas in the States of Uttar Pradesh, Madhya Pradesh and Gujarat. Indiscriminate misuse of land by disturbing the prevailing ecology has been responsible for this degradation. Loose and friable nature of the soil, steep slopes and undulating terrain, faulty agricultural practices, illicit cutting of trees, bushes, etc., uncontrolled grazing and other biotic interference have aggravated the problems leading to erosion and raincuts, and ultimately resulting in deep gullies, popularly known as ravines. Ravine formation has done immense damage to fertile cultivable lands along the river banks of the regions. Gullies and ravines are estimated to have damaged 3.67 million ha in Uttar Pradesh, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Punjab Bihar, Tamil Nadu, and West Bengal. Uttar Pradesh has the highest area affected, it being 1.23 million ha. In Madhya Pradesh, Bihar, Rajasthan and Gujarat, the areas affected are 0.68, 0.60, 0.45 and 0.40 million ha respectively. The details have been given in Chapter 18 on Soil and Moisture Conservation.

42.10.11 The Royal Commission on Agriculture recognised that ravine problems required special attention and suggested that continued afforestation of the ravine tracts should be taken up as a main remedy for soil erosion. The Government of India constituted a Central Ravine Reclamation Board in 1967 to ensure ravine control on proper lines and a more rapid development of the areas. Till 1970-71, 49,720 ha only were treated under ravine reclamation schemes, of which 45,840 ha were afforested and the balance reclaimed for agriculture. Apparently in Gujarat, from which only data on the progress of ravine reclamation from the Third Plan to the end of Fourth Plan were received, agricultural lands received a greater attention after 1970-71. Upto 1970-71, only 780 ha of agricultural lands were tackled, and 12,420 ha for ravine afforestation. However, considering the period covered by the Third Plan to the end of the Fourth Plan, the figures stood at about 30,900 ha of agricultural lands and about 18,500 ha for ravine afforestation. A multidisciplinary approach to ravine reclamation has already been accepted in the most affected States, and is likely to be followed in future years. We would like to add that the ravines starting from their upper end to their confluence with the main river should be treated as a whole. In general, the heads of the ravines should be treated for developing grasslands in association with animal husbandry programme, while the middle to lower slopes and deep ravines should be tackled by afforestation, supplemented by necessary engineering structures. No grazing should be allowed in the developed grasslands and the areas afforested. However, grass should be cut and removed for feeding livestock outside the area.

Control of *Chos* and Reclamation of *Cho* Lands

42.10.12 An enormous sediment load is carried by hill torrents, called the *chos*, emanating from the Siwaliks. The sediments get deposited when the *cho* debouch on the plains where it divides and subdivides and ultimately disappears after about 20-25 km from the foothills. Such devastations of *cho* in Punjab alone have affected about 2.5 lakh ha of fertile land. Out of this, 1.8 lakh ha occur in Hoshiarpur district alone. The Punjab Forest Department took the lead in initiating action on the control of *chos* and reclamation of the *cho* devastated land for better land-use, from the beginning of this century. It has developed the technique and gained considerable experience. Afforestation appears to be the best solution, and the technique already evolved by the Punjab Forest Department should be extensively adopted.

Forestry in Other Erodable Areas

42.10.13 Afforestation of wastelands with fast growing species could be helpful in converting large areas of such lands for other useful purposes. This would also help in further arresting the deterioration of the soil, and hence in the lessening of the soil conservation problem that such wastelands create.

42.10.14 In the matter of sand dunes in the hot desert, we have formulated our recommendations in the Interim Report on Desert Development. There are large areas along the coastal line lying under comparatively smaller sand dunes, especially in the coastal districts of Tamil Nadu, Maharashtra, Gujarat and Orissa. The area under coastal sand dunes is on the increase and the blown sand causes serious damage to the standing crops in its neighbourhood. Where plantations of *Casuarina* on the shore, backed by coconuts etc., have been taken up to control the blowing sand, as in Tamil Nadu, the trouble has been considerably minimised. The Forest Departments, having developed the necessary technology and gained experience in this regard, should take up coastal plantations of *Casuarina*, eucalypts, coconut, etc. extensively for profitable land-use and controlling erosion of the coastal tracts.

Research and Training

42.10.15 Experiments have been conducted by the silviculturists in different States in consultation with the FRI on evolving suitable guidelines in reclothing the different categories of denuded areas and improving the forests and grasslands both for protection of land against erosion hazards and for proper and economic utilisation of land not capable of sustaining other forms of agriculture. Some studies on forests influence have also been carried out, but they have not been extensive. We have indicated a few fields for silvics research in this connection later in Chapter 46 on Forest Planning, Research and Education.

42.10.16 For training in soil and water conservation, there is the Central Soil and Water Conservation Research and Training Institute at Dehra Dun, with six substations under it. They are to: (a) carry out research on specific regional problems with a view to developing criteria for erosion hazards and establishing standards of efficiency for the various soil and moisture conservation practices, individually and in combination, (b) carry out fundamental research on hydrological laws governing the watershed behaviour under different

management practices and (c) serve as administration centres for developing proper knowhow for soil conservation measures. The institute at Dehra Dun deals, *inter alia*, with the problems in connection with erosion control in the Himalayas and establishment of forestry. The substations at Kota, Vasad and Agra also deal with forestry problems in the ravines. The Chandigarh substation deals with the problems of erosion control in the Siwaliks and training of *chos*. The substation at Ootacamund deals, amongst others, with development of techniques for establishment of pastures and forestry. A regular training programme in soil and moisture conservation has been taken up in some of the substations, but the Forest Departments do not take adequate advantage of the training facilities available. From what we have stated before, it is evident that soil and moisture conservation measures should be taken up as an important part of improved land-use programme. The various land-use programmes would have to be coordinated, and very often it would be found that it becomes convenient to entrust the works of soil conservation even in agricultural areas to the Forest Departments. Whether it is for soil conservation through forestry or through an integral programme, trained personnel in the Forest Departments are essential. The programmes that we have outlined would require a large number of forestry personnel trained in soil and moisture conservation. We, therefore, urge the State Forest Departments to assess their requirement of training for higher professional staff, Forest Rangers, Deputy Rangers/Foresters, etc., and to avail of the training facilities that are available or that would be created in future in different training centres.

11 GRAZING IN THE FORESTS

42.11.1 As stated in Chapter 41 on Forest Policy, the national forest policy should recognise that grazing in the forests would have to be allowed in view of the role of livestock in the country's economy. But instead of unlimited and continuous grazing, it should be controlled and restricted so that it does not interfere with the productive and protective functions of the forests. The resources of the forest areas should be utilised for feeding of the essential livestock only. Grazing by goats in all forests should be prohibited. Sheep grazing may be allowed only in specially earmarked grasslands in the forest areas under strict rotational control. In this section we have given a brief account of the past and present problem of grazing in the forest and made necessary recommendations.

Dr. Voelcker's Report and 1894 Forest Policy

42.11.2 Towards the end of the last century, the Government of India invited Dr. J. A. Voelcker to examine the condition of Indian agriculture and to suggest how it could be improved. He submitted his report in 1893, in which he dealt also with the principles that should govern the admittance of grazing in areas set apart for being managed as forests. He observed as follows :

"The Government of India issued in March, 1883, a Resolution calling attention to the growing decrease in the area of grazing land and wooded tracts in many parts, and to the damage done through excessive grazing. I am in full sympathy with the Forest Department in their contention that where the object is to grow timber it is necessary to close these forests to grazing, or at least only to open certain blocks at a time. I can quite understand, too, the damage that will be done to a forest where reproduction is going on either on account of cattle trampling down the seedlings, or by goats, or by goats and sheep nibbling off young shoots. Goats, in particular, must have no place in a forest of this kind. Forests may be so suited or naturally so adapted that timber growing may not always be the main end to be sought, and small timber, firewood, grass etc., should in many cases be the main consideration. No action would, I am sure, do more to render the Department popular, and its work one of widespreading benefit, could it be instructed to carry out such objects as the provision, for agricultural community primarily, of facilities for obtaining what they require, viz. Small timber, wood for implements, firewood, leaves, grass or where possible grazing. The way in which supply of wood to agriculturists can be increased is by the creation of 'Fuel and Fodder Reserves'. The privilege of using these 'reserves' should be exercised by the granting of an annual license on payment of a certain yearly sum entitling the holder to timber, firewood, grass etc., in specified portions of the reserve so long as these are required for the domestic use, but *not for sale*, also to grazing (when it can be allowed) for cattle which are the *bonafide* property of cultivators."

42.11.3 The Government of India gave due consideration to these suggestions and incorporated them in the Resolution enunciating their forest policy.* According to this policy, the forests were to be broadly classified into the following classes :

- (i) forests the preservation of which is essential on climatic or physical grounds;

*vide circular No. 22-F dated 19th October, 1894.

- (ii) forests which afford a supply of valuable timbers for commercial purposes;
- (iii) minor forests; and
- (iv) pasture lands.

The Government of India laid down that minor forests and pastures and grazing grounds must be managed mainly in the interests of the population of the tract. In regard to both fuel and fodder reserves and to purely grazing areas especially such as lay in the midst of cultivated tracts, they asked Local Governments to consider whether it was necessary to class these; or if they were already so-classed, to retain them as forest areas, and if this question were decided in the affirmative, whether it would not be better to constitute them as protected rather than as reserved forests.

Views of the Royal Commission on Agriculture

42.11.4 The RCA expressed agreement with the exposition of the general policy mentioned above. They also stated that both from the agricultural and forest point of view, the replacement of grazing by grass cutting would, in many instance, be an improvement. There are also advantages from the point of view of livestock and minimisation of the risk of damage to the forests. They further stated: "It is desirable, in the interests both of forest conservancy and of cattle improvement, that the grazing of inferior cattle in the forests should be discouraged. In all cases, the aim should be to secure a due proportion of grass cutting to grazing in each forest tract. Preference in regard to grazing should also, as far as practicable, be given to young stock and to animals of good quality. Since it cannot be doubted that grazing in forests will, for a very long time to come, be an important feature of forest economy, we consider it essential that the intensity of grazing consistent both with the proper development of the forest and the preservation of desirable grasses should be determined as soon as possible."

42.11.5 The dual role of forests as grass reserves in times of scarcity and famine and as sources of annual supply of grass to cultivators was recognised by the RCA. It is, however, only the cultivators who do not live far from forests that are benefited from the forests in this way. The RCA acknowledged the capacity of the forest lands in certain parts of the country to supply grass in large quantities and wanted that by means of propaganda the use of dried grass for feeding should be increased and inhibition of the cultivators in this regard overcome. To lower costs, they recommended that the railways should charge the lowest rate for transport of grass. As a

general measure of famine relief, the storage of hay was recommended.

42.11.6 A very significant recommendation of the RCA relates to the areas officially classified as 'culturable waste' and "land not available for cultivation". They thought that within these vast areas, there could be found much land which, though unsuited for commercial afforestation, might be used to grow fuel and provide better grazing than it then did, or might be added to the village forests managed by *panchayats*. They recommended structural changes in forest administration and training of staff for experimental work in silviculture and grassland improvement, so that progress could be made in the solution of the difficult problem of grazing, by attempting to use to better advantage the vast areas classed as waste.

Forest Grazing in National Forest Policy, 1952

42.11.7 Even while admitting the need for ensuring progressively increased supplies of grazing as one of the paramount needs of the country, the National Forest Policy, 1952 made some observations on the subject of admitting grazing in the forests. The Policy stated that efficient forest management requires grazing to be regulated as regards time and place, as also the number of cattle admitted. Forest grazing was to be based on the following cardinal principles :

- (i) Continuous grazing on the same areas by large herds is destructive to the better strains of grasses and leads to a deterioration of the grass complex. Wherever it is permitted and is in great demand, efforts should be made to introduce rotational grazing, the benefits of which should be explained and demonstrated to the villagers.
- (ii) Cheap forest grazing has a demoralising effect and leads to the vicious spiral of reckless increase in the number of cattle, inadequate forest grazing, reduced quality of the herds and further increase in the numbers to offset the fall in quality. Free and indiscriminate forest grazing is, therefore, a serious disservice to cattle breeding. The notion that a farmer's wealth must be reckoned in terms of the cattle he owns, regardless of quality, is one of the causes of India's uneconomic cattle wealth and must be combated.
- (iii) Grazing should not be looked upon primarily as a source of revenue. But the simple and obvious way of regulating and controlling grazing, as also improving the quality both of grazing and cattle themselves, is to institute a reasonable fee for the privilege of grazing.

- (iv) Grazing must not be allowed in regeneration areas and young plantations during such periods as the seedlings require for establishment.
- (v) Grazing incidence should be kept at a minimum in 'protection forests', i.e. those forests which must be preserved or created for physical and climatic considerations.

42.11.8 The National Forest Policy, 1952 stated that the damage to young plants caused by the browsing of sheep and goats is often irreparable, and their admission into the forest is incompatible with the aims and objects of forest management. Experience gained in India and elsewhere points to the imposition of restrictions on sheep grazing in forests, and the total exclusion of goats therefrom. The Policy recommended the creation of special fodder reserves under strict rotational control for the purpose.

Dimension of the Problem

42.11.9 We are dealing with the problem from three different angles, viz. grazing incidence, rights and privileges and regulatory provisions. It is very difficult to make a quantitative estimate of incidence of grazing in the forests. As no data are collected in the All India Livestock Census on the source of their grazing or fodder, we had to depend on figures reported by the Chief Conservators of Forests. Rights and privileges vary so widely from State to State that it is difficult to make an assessment of the situation, without detailed sample studies. Moreover, in the same State the position varies widely from one part to another. For regulation, some States have laid down rules separately, and in others the provision is included in the working plans only. We have based our views on the information secured with the above limitations.

42.11.10 From the available statistics it is found that while the total livestock in India increased from about 302 million in 1956 to 355 million in 1972 (by about 18 per cent), the total number of animals which grazed in forests increased from about 35 million to about 54 million (by about 52 per cent). As a result, the percentage of all animals grazed in the forests rose from 11.5 to 15.4. Appendix 42.10 gives the comparative figures for grazing in 1957-58 and 1973-74. The figures for 1973-74 do not include the animals grazed in forests in the States of Karnataka, Kerala, Manipur, Meghalaya, Nagaland and West Bengal, from where figures were not available. If figures for these States are taken into considerations, incidence of grazing in forests will be much higher. In 1961, with a geographical area which is 2.2 per cent of that of the world, India had 19 per cent of the world's cattle, 50 per cent of the world's buffaloes and about 18 per cent of

the goats¹. Since then, livestock population has increased by more than 50 million and comparatively a much greater pressure is exerted on forests for grazing.

42.11.11 The practice of limiting the number of cattle to the carrying capacity of the forests, based on arbitrary assumptions, has been in vogue in certain States. Some of these figures are given in Table 42.8. Taking the case of Bihar, it is found that through grazing incidence in forest is sought to be regulated at 0.8 ha per cow unit, i.e. 125 cow units over 100 ha, the actual incidence is more than three times. We have presented the grazing incidence for the States for which figures are available in Appendix 42.11. Equivalence to cow units has been assumed as under :

buffaloes	2
sheep and goats	$\frac{1}{2}$
camels	8
other animals	1

TABLE 42.8
Optimal Grazing Incidence^{2,3}

State	ha per cow unit	ha per buffalo unit
Assam (1957)	1.20	2.40
Bihar	0.80	..
Orissa	1.60	2.40
Tamil Nadu	1.20	..
Uttar Pradesh	0.40 (according to to locality in eastern circle) 0.80	..
West Bengal	6.00 (Kalimpong Division)	4.00 (Jalpaiguri Division)

42.11.12 There is a paucity of studies regarding carrying capacity of forests for grazing. Kumar⁴ has given carrying capacity in terms of rainfall. To provide enough feed during the season, for one animal in different rainfall tracts, the area required expressed in ha per animal would be : above 2,540 mm rainfall 0.2 to 0.3 ha per animal; 1,270-1,905 mm rainfall 0.4 to 0.6; 890-1,270 mm rainfall 0.8 to 1.0; 635-890 mm rainfall 1.2 to 1.6 and below 510 mm rainfall 1.6 to 2.0. This

¹ 1961. One Hundred Years of Indian Forestry, Vol II : p 57. Dehra Dun, Forest Research Institute and Colleges.

² Venkataramanan, S. V., 1959. Grazing Management in Indian Forests. South For. Rang. Coll. Mag., 35 (1, 2 & 3).

³ Whyte, R. O., 1964. The Grassland and Fodder Resources of India : p 410 (Table 101). New Delhi, ICAR

⁴ Kumar, L.S.S., 1946. Better Utilisation of Forest Grasslands in Bombay Provinces, Ind. For., 72(4).

would obviously apply under conditions in which grassland is maintained artificially in a woodland climate under a regime of deliberate regression'. But objects of forest management in most cases would be different. Similar figures of carrying capacity have also been reported from Bihar, carrying capacity being dependent on the conditions of the vegetation which in turn depends on the rainfall.² These findings require further studies. As an average for the country, an indication was given in the 'One Hundred Years of Indian Forestry' referred to earlier that 1.6 ha per cow unit (i.e. about 60 cow units per 100 ha) would roughly constitute conservative grazing. When figures are compared with those given in Appendix 42.11 it is seen that safe margin of forest grazing has been far exceeded.

42.11.13 Regarding grasslands, some studies on carrying capacity for grazing have been made. The results of investigations carried out in Tamil Nadu have shown that the carrying capacity of grasslands when grazed continuously should not exceed one cow per 2.0 ha, while a carrying capacity of 1 cow unit per ha would be about correct for grasslands which are improved as a result of closure³ Preliminary studies undertaken at Pali (Rajasthan) on carrying capacity of grasslands in different stages of deterioration have indicated an average carrying capacity of 5 sheep per ha per annum based on a 70 per cent utilisation of the herbage; but if a moderate utilisation of only 35-40 per cent, which would lead to the improvement of these 'poor' condition grasslands, were to be considered, the grazing rate would be reduced to 2.5 wethers/ha per annum⁴. Sown pastures of *Cenchrus ciliaris* Linn. could, however, support 7.6 sheep per ha without impairing the grassland. Grazing studies with heifers conducted in the rocky grassland of low productivity of Kailana (near Jodhpur, Rajasthan) revealed that light intensity grazing (6 ha per cattle) allowed 60 per cent utilisation of the vegetation consistent with animal growth and range conservation⁵. It has been mentioned also that the grazing capacity on a year long basis for different "condition class" grasslands in Western Rajasthan may be taken as: 25-30, 20, 17 and 10 adult cattle units per 100 ha of grassland in "excellent", "good", "fair" and "poor" condition grasslands respectively⁶.

¹ Venkataramanan, S. V., 1959 Grazing Management in Indian Forests. South. For Rang. Coll. Mag. 35(1, 2 & 3).

² Prasad, S. K., 1956. Problem of Grazing in Bihar—Improvement and Protection of Grazing Areas, Ind. For., 82(1).

³ Wilson, J. A., 1951. Grazing Management and Improvement in Madras Province, Proc. Seventh Silv. Conf., Dehra Dun, FRI.

⁴ Whyte, R. O., 1964. The Grassland and Fodder Resources of India, New Delhi, ICAR.

⁵ Kaul, R. N. & Chakravarty, A. K., 1968. Range Development in Western Rajasthan, Abstract of Paper's Symp. on Natural Resources of Rajasthan, Jodhpur.

⁶ Bhimaya, C. P. & Ahuja, L. D., 1969. Criteria for Determining Condition Class of Range Lands in Western Rajasthan, Annals of Arid Zone, 8(1).

42.11.14 Grazing rights, privileges and concessions in lands under the control of the Forest Departments vary from State to State. Concessions are generally in the form of low rates for grazing, if not free. A few examples as given below will explain. In Andhra Pradesh, some grazing fees were levied from the time the State was constituted, but from 1968-69 forest grazing has been made free. In Bihar, rates for grazing promulgated in 1950 remain unchanged, except for the southern circle, where the rates are Re. 1.00 per head per year for cattle and Rs. 4.00 for buffaloes. The old rates for the villages within a radius of 8 km from forest is only Re. 0.12 per head per year for adult bullocks and 0.25 for adult buffaloes, with half the rate for calves above 2 years of age and free for those below 2 years of age. For villages beyond 8 km radius, the rates are only double. In Himachal Pradesh, where almost all forests are open to grazing, the fees have not been changed since 1950. They are still very low — for cows Re. 1.00 per head per year, buffalo Rs. 8.00, sheep Rs. 0.19 and goats Re. 0.37. Comparatively, the rates are high in West Bengal only. But even there the rates have not practically been changed in the last 25 years or so.

42.11.15 Rights and privileges for grazing are allowed under various forest regulations. Some of the States have enacted their own grazing regulations. Generally, no grazing rights are recognised as such in reserved forests, though grazing is allowed with or without fees in these forests as well. There are special provisions for tribals also. In Andhra Pradesh, the tribals in Telangana region and *Chenchus* in Kurnool district have a right for free grazing. In Andhra region, the scheduled tribes have the right of free grazing in forests. In Tamil Nadu, free grazing is allowed to the Malayalees under hill village system in Vellore, Dharmapuri, Tirupattur and Salem Divisions in return for the help rendered by them to the Forest Department in the protection of forests from fires and theft. Free grazing is also allowed for cattle belonging to the tribes — *Todas* and *Kothis* — in the Nilgiris, residents in the enclosure of the Mudumalai Wildlife Sanctuary.

42.11.16 One of the methods adopted for controlled grazing is the setting up of grazing settlements, adopted by Madhya Pradesh and Maharashtra. In Madhya Pradesh, though grazing settlements are prescribed in each revision of the working plan, they have lost all significance, as the State Government has removed all restrictions on the incidence of grazing. In Maharashtra, the concept of grazing settlements has been built into the grazing policy of the State. Grazing settlement work has been completed in many districts and the same is in progress in other districts.

42.11.17 Grazing policy in Maharashtra seeks to ultimately provide "ideal pasturage within the resources available in the State forests without letting the resource itself to impair and deteriorate. It has further to be based on sound principles of forestry." We are indicating the main points covered in the grazing rules framed in 1973 by the Government of Maharashtra to illustrate the regulatory character of forest grazing. These are :

- (i) all grazing in the forest (whether free or otherwise) would be on permit only ;
- (ii) each forest division will be divided into grazing units, and the issue of license is subject to such definite allotment of villages to a particular grazing unit, to such limitation on the number of cattle to be grazed in any such unit, as may have been ordered by Government after special enquiry, and also to such closure to grazing as may be enforced in accordance with the prescriptions of sanctioned working plans ;
- (iii) for excess cattle, licenses at prescribed rates may be taken out for any grazing unit, provided there is room in the grazing unit ;
- (iv) for free grazing of cattle of cultivator family and others, licenses are limited to the period June 15 to July 31 only ;
- (v) a grazing license may be refused over a period of one year to any individual, who has been guilty of persistent illicit grazing, on the order of the Conservator of Forests. Government likewise may refuse grazing license for a community, whose members have been guilty of persistent illicit grazing ;
- (vi) computation of cattle units are made as per the following :

	equivalent cattle units	grazing fees (Rs. per annum)
adult buffalo	2	2.00
adult cow, bull or bullock	1	1.00
buffalo calf (less than 3 years but more than 6 months old)	1	1.00
cow calf (less than 3 years but more than 6 months old)	$\frac{1}{2}$	0.50

- (vii) essential cattle, subject to a maximum of two plough units per cultivator family, should be allowed free grazing in forests. A plough unit shall mean 4 cattle units ;
- (viii) the *patwaris*/*Talathis*/*Gram Sevaks* shall issue a certificate on demand to all cultivator families entitled to graze their cattle free. On production of the certificate, a cultivator

family shall be entitled to obtained a license for free grazing and at prescribed rates for such animals as are admissible under the rules; and

- (ix) each grazing unit and the villages served by it shall constitute a grazing circle. For each such circle, a headquarters shall be fixed, where the License Vendor (persons authorised to issue licenses) shall ordinarily reside. Each circle shall further be sub-divided into a convenient number of sub-circles and a centrally situated village shall be fixed for each sub-circle at which license shall be issued for the sub-circle.

42.11.18 Classification of forest areas and maximum grazing incidence for each category, as proposed in the grazing policy of Maharashtra, are as under :

- (i) protected Forests — This category will include steep and precipitous forests (especially those in the catchment areas of important river valley projects) and also the denuded land which are in dire need of soil conservation and afforestation. Grazing should be altogether prohibited in these forests save in exceptional cases, when too the incidence should not exceed one cattle unit for 4 hectares.
- (ii) Tree Forests — This category will include forests where production of timber is the main object of management. The grazing incidence for these forests should be one cattle unit for 1.2 ha.
- (iii) Minor Forests — This category will comprise forests in which production of fuelwood on a sustained basis is the prime object of management. The grazing incidence for these forests should be one cattle unit for 0.6 to 0.8 ha.
- (iv) Pasture Lands — This category will include openly stocked forests or lands that have ceased to yield even small timber but which are conveniently situated for providing grazing to the adjoining cattle population. The grazing incidence for these lands should be one cattle unit per 0.4 ha.
- (v) Grass Reserve — This category will include all forest areas set apart for the production of good fodder grass. Grazing should be completely eliminated from these areas, but cutting of grass may be permitted.

Provision and Control of Grazing in Forests

42.11.19 Grazing *per se* (except for goats) is not inimical to forest growth; in fact, a light grazing improves regeneration conditions, particularly in moister type of forests. We have pointed out earlier how

with the increase of the livestock population, proportionately a far greater demand for grazing fell on forests. This is also borne out by the concessions which have been extended in recent years to grazing in the forest. Though hardly any scientific investigation has been carried out to determine the carrying capacity of different types of forests and only arbitrary assumptions made, empirical evidence points to an incidence of grazing in forests far exceeding the safe limits. Both for the sake of development of forest resource and animal husbandry resource, positive steps for regulation of grazing supplemented by efforts to increase grass production and pasturage would have to be taken.

42.11.20 The degree of regulating grazing in forests should be guided by their classification according to the functions they are primarily to fulfil under management. In Chapter 41 on Forest Policy we have recommended that forests should be functionally classified into: (a) protection forests, (b) production forests, and (c) social forests. Attempts should be made to prohibit grazing completely in protection forests. It is quite possible that in some States, like Himachal Pradesh, such prohibition cannot be enforced immediately. In these exceptional cases, closure should be applied gradually and in the meantime only very light grazing permitted. There is no research base for finding out what is light grazing. Hence, research should be taken up immediately to fix an optimum grazing incidence. A few upper catchments of river valley projects should be selected so that investigations into the carrying capacity of protection forests are carried out not only on the basis of floral composition, but also from the point of view of the effect of grazing on soil and water conservation. In the production forests, the primary concern would be the commercial production of industrial wood, and grazing can be treated only as a fringe benefit. The provision of grazing and grass would be one of the primary objectives of social forestry.

42.11.21 In the matter of control of grazing in wildlife sanctuaries, mention should be made of the work being done in the Gir sanctuary in Gujarat. The problem is being tackled in two ways: (a) shifting *Maldhari* families (the graziers) outside the sanctuary and settling them on *vidis* (grasslands) elsewhere and on other Government lands; the *Maldharis* are cooperating in making the programme a success; and (b) constructing a rubble wall all round the sanctuary to stop seasonal influx of cattle for grazing and for controlling poaching, illegal felling of trees, etc. The rubble wall — no more than one metre in height — has proved a remarkable success. Even in the short span of one year since the wall was completed, there was much less lopping and grass

had come up very well within the walled area, despite one of the worst rainfall years in near past and extraction of large quantities of grass and fodder being allowed as headloads during the scarcity months. A recent wildlife census has also shown considerable increase in the number of herbivores. People owning livestock in the vicinity of wildlife preserves should be persuaded to take to stall feeding, for which permission to cut grass and fodder in a controlled manner may be given. It will benefit management of wildlife and its habitat, as well as development of animal husbandry.

42.11.22 Grazing rules should be promulgated by each State Government*. The rules should specify the grazing rates and should provide for the manner in which grazing should be admitted, grazing units constituted, carrying capacity fixed, grazing and closure cycle indicated and administration of rules carried out. We have referred to certain provisions of the Maharashtra grazing rules in paragraphs 42.11.17 and 42.11.18 above. With regard to the carrying capacity we consider it unlikely that the grazing incidence in most of the production forests can be raised beyond 1.6 ha per cow unit, young regeneration areas being excluded. Research should be carried out for fixing carrying capacity of all types of forests, including those to be created under the social forestry programme.

42.11.23 As regards grazing rates, by all accounts these are pitifully low at present and must be upgraded substantially. As we have mentioned in our suggestions for a revised national forest policy in Chapter 41, grazing fees should be a deterrent to curb the admittance of non-essential cattle in forests, though grazing should not be looked upon as a source of revenue. Ordinarily the rates charged for grazing should adequately cover the cost of management (including cultural works) and watch and ward.

42.11.24 Grazing should be completely prohibited in the young regeneration areas. In areas taken up for regeneration of forests or afforestation, generally complete protection from grazing would have to be afforded till the plantations are 3 to 10 years old, depending on the particular species and site quality. This factor should be taken into consideration for setting apart grazing settlements. Grasses should be allowed to be cut from these areas and the hay utilised for feeding the essential livestock outside the forests.

42.11.25 In the dry and arid areas the forests are generally of the open type, falling mostly under the forest type 'dry tropical forests'. The sub-type tropical dry deciduous forests occur in the rainfall zones of 750 to 1,250 mm and tropical thorn forests in the zones of 125 to

* In this connection, we refer to the Government of Maharashtra, Revenue and Forests Department Resolution MFP-1371/237035-Z dated November 3, 1973.

750 mm of rainfall. The tropical dry deciduous forests towards the lower side of the rainfall scale are generally of the open forest type subject to severe biotic factors such as overgrazing and heavy annual fire, and there is often a dense growth of grass in the rainy season. The tropical thorn forests are found in the desertic and arid regions of Rajasthan, Punjab, Haryana, Western Uttar Pradesh, Gujarat and the central dry region of the peninsula proper situated in the rain shadow of the mountain systems bordering the triangle. This is open low forest with scattered thorny wood species and natural grass.

42.11.26 The natural grasslands in the above type of forests are used for extensive grazing. The area of such grasslands under the control of the Forest Departments is not definitely known. An attempt was made by the State Government of Gujarat to take up improvement of grasslands in the dry regions of the State, viz. Saurashtra and Kutch. It was found that these grasslands are scattered in small patches surrounded by cultivation and habitation. The total area of such grasslands in these regions of Gujarat was about 1.6 lakh ha. Grazing has been prohibited in these grasslands, which are being managed as grass reserves since the Second Plan. The hay from these grass reserves are stored in fodder banks to meet the requirement during drought periods. A full account of the method adopted in Gujarat for improvement of these grasslands are given in Appendix 42.12.

42.11.27 For the sake of balanced forest development in the whole economy, forest grazing should not be handled as a fringe activity of the organisation created for timber harvest or plantations or commercial forestry. We have recommended the creation of an extension wing in the Forest Departments to take up works under social forestry. Where a large programme of grassland development is taken up by the Forest Departments, they should employ adequate number of agrostologists/agronomists and range management specialists. It should also be ensured that once the programme of grassland development, including grass reserves, is taken up by the Forest Departments, the areas on no account be converted later into forest plantations. It would be necessary to conduct intensive research on forest grazing for determining, by systematically conducted experiments, the optimum grazing-closure cycle and the maximum permissible grazing incidence in different classes of forests, and also in improving the grass reserves. Accordingly in the State forest research organisations, agrostologists/agronomists should be entrusted with such research works, to be conducted in collaboration with the agricultural universities and experts from Agriculture, Animal Husbandry and Sheep Development Departments.

42.11.28 The improvement and maintenance of grasslands and open forests suitable for management as grass reserves should be part

of a multidisciplinary approach to the livestock feeds and fodder problem. The available pasture lands and wastelands in the neighbourhood of the forests should also be improved in an integrated manner for provision of grazing and hay for the livestock in the region. We have indicated in Chapter 25 on Fodder Crops that there has to be a systematic survey of wastelands and village common lands in the different States, with a view to preparing a land-use plan based on a village or a group of villages as a unit. Where a minimum area of 20 ha is available in a compact block, development of mixed forestry (as defined in Section 9 of this chapter) should be taken up by the Forest Departments, protection being the responsibility of the *panchayats* but the income being divided equally between the *panchayats* and the Forest Departments. Development of fodder and grass should be an important component of mixed forestry. There would also be considerable scope for growing grasses and fodder along with trees in the plantations raised on lands on the sides of roads, canal banks and railway lines under social forestry. The areas that cannot be covered under social forestry should be developed by the Animal Husbandry Departments for additional grazing/production of hay. We have also said that all blocks of over 200 ha of Government wastelands should be taken up progressively for development as range lands by the Animal Husbandry/Sheep Development Departments, by consolidation of lands where necessary. However, where it is considered necessary to entrust the work to the Forest Departments, there should be a regular consultation between the concerned officers of the Animal Husbandry/Sheep Development and the Forest Departments for planning the range development programme.

42.11.29 Grassland development is necessary for implementation of the livestock development programme. In fact, as explained in Chapter 25 on Fodder Crops, both the programmes should go together so that the grassland development programme becomes economic and the owners of the livestock are in a position to pay a reasonable price for the hay as well as for the fees for controlled grazing. Apart from the Forest Departments, other departments would also be involved. It is, therefore, essential that in every State there should be a machinery for proper coordination and implementation of the programme. A State level standing committee should be constituted and should be headed by the Agricultural Production Commissioner and should have as members Heads of the Departments of Agriculture, Forest, Soil Conservation, Dairy Development, Sheep Development and Animal Husbandry. The Director of Animal Husbandry should be the member secretary of this committee. This committee should assess feed and fodder requirements of the States, review the programmes of grass-

land and fodder development activities, coordinate the activities of concerned departments in the field of grassland and fodder development, lay down the policies and time bound action programmes, and take effective steps for implementation of these programmes through the various concerned departments. Similar coordination committees should be set up at the district level with representation from the various concerned departments under the chairmanship of the Chief Agriculture Development Officer*.

Introduction of Tree Fodder Species in the Forests

42.11.30 We have explained the importance of tree and shrub leaves as fodder in Chapter 25 on Fodder Crops. In view of the fact that hay making and ensilage are hardly practised in many parts of the country, leaf fodder is the only alternative to grass in seasons when grass is scarce. In a few cases, fodder from trees and shrubs is used regularly, even when grass is available in plenty. The examples are feeding of the leaves of *anjan* (*Hardwickia binata* Roxb.) in Central India, and shoots and leaves of *krishna sirisha* (*Albizia amara* Boivin) and posts of *hiwar* (*Acacia leucophloea* Willd.) in Tamil Nadu. There are very few areas, apart from the reserved forests, where lopping of trees is regulated. Even in the reserved forest areas, it is becoming increasingly difficult to control lopping and cutting of shrubs for fodder, in view of the pressure of the livestock population. Generally everywhere in the country there is little attempt at regulation of lopping of trees in private forests, scrub jungles, common village lands, in avenues, etc., and trees are often lopped to depth.

42.11.31 Whyte¹ has given examples of various working plan prescriptions for introduction of fodder trees in plantations. In addition, some working plans prescribe that lopping of trees for manure and fodder should be permitted in coupes under felling, just ahead of the felling, thus making it possible to utilise leaves which would otherwise be wasted. With the production forestry being organised on commercial scale, there may not be much scope for deliberate introduction of fodder trees in such commercial plantations, except for allowing lopping of fodder leaves in the felling coupes, just ahead of the felling. However, there would be an extensive scope for plantation of fodder trees to be taken up as a part of social forestry. Introduction of this programme however should be coupled with: (a) hay making and ensilage on a wide scale and (b) livestock development programme.

* Also see Chapter 62 on Administration.

¹ Whyte, R. O., 1964. The Grassland and Fodder Resources of India : pp 161-64, New Delhi, ICAR.

12 FOREST BASED TRIBAL DEVELOPMENT

42.12.1 The major problem in the productive uses of forests in the tribal regions is the shifting cultivation practised by the tribals in the forests. Shifting cultivation is not a speciality of Indian tribes. It is practised, with some variations, throughout the tropical and sub-tropical regions of the world. Under this system, the forest and undergrowth are cleared and the slash is burned. Soil is not turned up with plough, and seeds are either broadcast or sown into dibbled holes. Usually two or three crops in as many years are raised on such plots and thereafter the cultivation shifts to another new plot which is similarly treated. The yield depends on the presence of humus on the original forest floor and the minerals obtained on burning of the slash. So the same area is cultivated as long it yields subsistence. Since the forest area is limited, sooner or later shifting cultivation returns to the same area. Yield in the second rotation is less, because the fertility does not build up to the original level and the soil is subject to natural erosion processes. So in every cycle rotation gets shorter as cultivation is done for a fewer number of years in the same area. Increase in numbers is also responsible for shortening cycles. The cycle of shifting cultivation thus gets shorter and shorter, and erosion takes heavier and heavier toll resulting in deteriorating economic condition of the shifting cultivators.

42.12.2 Shifting cultivation is known by various names in the country. In English language, it is also known as "slash-and-burn". In this country, it is known as *jhum* in Assam, Tripura and other North Eastern States. In Orissa, it is known as *podu* or *dhai*. in Madhya Pradesh *penda*, and in other parts of the country by other names. In West Africa, it is called farming and it is known as 'sartage' in the French and Belgian Ardenes. It goes by the name of *koholo* amongst the natives of South East Solomon Islands. The *Veddas* of Sri Lanka call it *chena*. Hereafter, we shall use throughout only the term *jhum* or shifting cultivation.

Extent of the Problem

42.12.3 No dependable statistics of the magnitude of the problem, i.e., number of persons (or families) practising *jhum* and total area of land under *jhum* annually, are available. It is only generally recognised that the problem is acute in Andhra Pradesh, Orissa, Tripura, Meghalaya, Mizoram, Manipur, Nagaland and Arunachal Pradesh. In Madhya Pradesh and Bihar, the practice is very limited.

Some attempts have been made earlier to quantify the problem. An ICAR study¹ gave the following magnitude based on 1956 estimate :

(i) total number of tribal households depending upon shifting cultivation	528,940
(ii) total tribal population depending upon shifting cultivation	2,644,200
(iii) total area of land utilised for shifting cultivation	1,355,300 (acres) or (542,100 ha)

The Report of the Scheduled Areas and Scheduled Tribes Commission, 1960-61 had concluded that 25.89 lakh tribals depend on shifting cultivation extended annually over an area of 5.41 lakh ha. Both the estimates are practically the same, and there are only minor variations in the statistics for individual States.

42.12.4 No systematic study has been made since then. An estimate of the magnitude of the problem for the North Eastern Region of India has, however, been made recently, and the available figures are given in Table 42.9 below :

TABLE 42.9
Shifting Cultivation in the North Eastern Region*

State/Union Territory	Total area affected by shifting cultivation at onetime (,000 ha)	Area under shifting cultivation (,000 ha)	Col.3 as percentage of Col. 2	Tribal families involved (,000 nos.)	Area cultivated per tribal family (has) (Col.3 ÷ Col. 5)
Arunachal Pradesh	248.58	92.00	37.0	148	0.62
Assam—					
(i) Mikir Hills	415.10	54.00	13.0	45	1.20
(ii) North Cachar Hills	83.20	15.60	18.5	13	1.20
Manipur	100.00	60.00	60.0	50	1.20
Meghalaya	416.00	76.00	18.2	68	1.12
Mizoram	604.03	61.61	10.2	45	1.37
Nagaland	608.06	73.54	12.1	80	0.92
Tripura	220.79	22.30	10.1	43	0.51
TOTAL	2,695.70	455.05	16.8	492	0.92

In the North Eastern India only, about 2.7 million ha of forest land are affected by *jhumming* and nearly half a million tribal families are involved. It is estimated that the *jhumming* cycle, which was 30-40 years a few decades back, varies at present between 1 to 17

¹ Kaith, D. C. 1958. Shifting Cultivation Practised in India. Review Series No. 24, ICAR.
* 1975. Control of Shifting Cultivation in the North Eastern Region. A note to NCA by Miss F. K. Wadia; Director (E&M), North Eastern Council Secretariat, Shillong.

years in Arunachal Pradesh, 4 to 5 years in Meghalaya, Mizoram and Tripura, 5 to 10 years in the Assam hills, 6 to 8 years in Manipur and 6 to 15 years in Nagaland. Bulk of the forest areas in Arunachal Pradesh, Mizoram, Nagaland, Meghalaya and Manipur are owned by the villages or the community. In these areas, the individual tribal families have little interest in improving the productivity or fertility of the soil, and that constitutes one of the main difficulties in these areas in controlling shifting cultivation or in weaning the tribal families away from this practice. Quantitative aspects of *jhumming* in Andhra Pradesh and Orissa, two other States where the problem is comparatively more acute, should be determined. Accuracy of the figures for the North Eastern Region also requires to be checked. The statistics in all the concerned States should be continuously reviewed through the forest statistical organisations that we have recommended to be set up in Chapter 46 on Forest Planning, Research and Education. Aerial photographs, coupled with field investigation, should be used to determine the extent of the problem accurately and for monitoring the future programme.

A Review of the Approach So Far

42.12.5 Shifting cultivation has been under study for a long time in India. Some other studies have also delved into the associated tribal economy. Apart from the research studies conducted by the tribal research institutes and universities, etc., and those conducted under their auspices, the following documents throw light on all aspects of tribal life in India :

- (1) Annual Reports of the Commissioner for Scheduled Castes and Scheduled Tribes.
- (2) Report of the Backward Classes Commission, 1955.
- (3) Report of the Study Team on Social Welfare and Welfare of Backward Classes, 1959.
- (4) Fortyeighth Report of the Estimates Committee of Parliament, 1959.
- (5) Report of the Committee on Special Multipurpose Tribal Development Blocks, 1960.
- (6) Report of the Scavenging Condition Enquiry Committee, 1960.
- (7) Report of the Scheduled Area and Scheduled Tribes (Dhebar) Commission, 1960-61.
- (8) Report of the Study Group on the Welfare of the Weaker Sections of the Village Community, 1961.
- (9) Report of the Special Working Group on Co-operation of Backward Classes, 1962.

- (10) Report on the Seminar on Employment of Scheduled Castes and Scheduled Tribes, 1964.
- (11) Report of the Advisory Committee on the Revision of Lists of Scheduled Castes and Scheduled Tribes, 1965.
- (12) Report of the Committee on Customary Rights to Scavenging, 1965.
- (13) Report of the Committee on Tribal Economy in Forest Areas, 1967.
- (14) Report of the Study Team on Tribal Development Programme, 1969.
- (15) Report of the Parliamentary Committee on the Welfare of Scheduled Castes and Scheduled Tribes, 1970.
- (16) Report of the Task Force of the Planning Commission, 1973.
- (17) Five year plan documents of the Planning Commission.

42.12.6 The Report of the Dhebar Commission has dealt with in considerable detail the tribal economy and shifting cultivation in their relation to forest management. We shall only refer here to such of the Dhebar Commission's observations and recommendations as would help the readers understand our approach to the problems. The Dhebar Commission divided the tribals into the following four categories :

- (i) those that are living in the remotest corners and for that reason are almost in a primitive stage ;
- (ii) those in the *jhumming* cultivation stage;
- (iii) those who have taken to regular agriculture ; and
- (iv) those that have been assimilated.

We deal mostly with the first two categories of tribals and their problems insofar as forest development is concerned in this section. The Dhebar Commission has observed that to a vast number of the tribal people the forest is intimately mixed with their livelihood. It recommended that the Forest Departments should undertake the responsibility of giving adequate employment to the tribals living in and around the forest areas. There should be a coordinated approach to provide employment opportunities in forest, agriculture, animal husbandry and industries for at least 300 days in a year. It was of the opinion that collection of minor forest produce is not at all likely to hinder the forest either in its growth or its preservation, and there is no justification for auctioning out the right to collect the minor forest produce or to have a middleman to exploit it. The Dhebar Commission recommended the approach of Gujarat, Maharashtra and Andhra Pradesh in having forest labourers' cooperative societies or co-operative finance and development corporations for forestry operations, involving major forests produce also.

42.12.7 The Dhebar Commission agreed that one of the major problems in the tribal areas is that of shifting cultivation, and it is not an ideal method. The total replacement of this system, if it comes at all, will be a long term process. Shifting cultivation is a mixed problem, partly connected with the physical conditions of the land and partly with social customs, traditions and beliefs. Any hurried departure may create complications. The only solution of the problem offered by the Dhebar Commission was to regulate shifting cultivation on scientific lines so as to limit its disadvantages and promote the fertility of the soil.

42.12.8 The Task Force on Development of Tribal Areas (1973) of the Planning Commission indicated that in the north-eastern zone, the tribals are mostly shifting cultivators, and *jhumming* is a major problem in this zone. In the eastern, central and western zones comprising the States of West Bengal, Bihar, Orissa, Madhya Pradesh, Uttar Pradesh, Gujarat and Rajasthan, problems of tribal development are related to, among other things, pressure of population on land, rights of tribals in forests and practice of shifting cultivation with lower production level. Southern zone tribes have also the primitive economy of *jhumming*. In spite of differences in problems between different zones, the Task Force contended, one of the few common features in the tribal economical life is collection of forest produce. The Task Force maintained that recent studies in India and abroad (references to studies not quoted) have led to a revised view on the subject of shifting cultivation and it is no longer being condemned as an outright evil. The Task Force did not recommend continuation of *jhum* indefinitely but it recommended that the practice of shifting cultivation should be made more productive by introducing better agricultural practices; wherever possible terracing or other means of cultivation should be introduced. It also suggested that growing of trees for commercial purposes such as bamboos and horticulture might be taken up in *jhum* areas to enable the tribals to supplement their incomes. The Task Force did not mention the fact that in Tripura it is the bamboo forest that are *jhummed*, and horticultural crops (e.g. pineapple) have also been raised, without any appreciable impact on the economy of the tribals in the region in the absence of complementary steps for proper marketing.

42.12.9 Regarding other measures for tribal development in forest areas, the Task Force recommended that :

- (i) Forest based industries will have to be located in tribal areas for diversification of employment opportunities; Minimum Wages Act might be extended to forest labour and enforcement machinery created for this purpose.

- (ii) Forest cooperatives may be set up to exploit forest areas and promote cottage and processing units.
- (iii) The permit system for collection of raw materials for these industries should be abolished and tribals be allowed to collect minor forest produce free of charge.
- (iv) There is a need to set up Forest Working Advisory Committee at various levels in different economic zones to seek cooperation of tribal people in management of forest areas.

Forest Policies of Different States on Shifting Cultivation

42.12.10 In Assam (Mikir Hills district), no prohibition is imposed by the State Government on *jhum* cultivation in unclassed State forests, barring the reserved forests. In Meghalaya, *jhum* is prohibited in reserved forests, but for other forest areas there is no Act or Regulation passed by the State on prohibition of shifting cultivation. However, there is a Regulation passed by the Garo Hills District Council, called the Garo Hills District (*Jhum*) Regulation, 1954, which provides for regulation and control of *jhum*. Under section 4 of this Regulation, *jhumming* is prohibited within :

- (i) a radius of 400 metre of any water source or catchment area declared as such by an order of the Executive Committee,
- (ii) a distance of 50 metre on either side of the roads of State Public Works Department and the District Council,
- (iii) any area which is covered by *sal* and other valuable trees, and
- (iv) any village or community forest constituted as such under Section 17 of the Garo Hills (Forest) Act, 1958.

Since the Executive Committee has not declared any area as catchment area nor has applied the Regulation strictly, at present there is no virtual control of *jhumming* in these forests. In Mizoram, there is no control of *jhum*. As there is no clear boundary demarcation of the reserved forests, *jhum* is extended at present to reserved forests also. The Government is taking action to consolidate reserved forest boundaries to control *jhum* to some extent. In Tripura, shifting cultivation is prohibited in all areas of reserved forests and proposed reserved forests. In these areas, *taungya* system of regenerating forest crops, mainly teak and *gambhar* (*Gmelina arborea* Roxb.) has been adopted, and in addition to right to *jhum* crops, the shifting cultivators are paid Rs. 125 per ha by the Forest Department for planting forest trees. There is no other regulation imposed on *jhum*. But *jhum* is virtually uncontrolled in the protected forests.

42.12.11 In Orissa, shifting cultivation is prohibited in reserved forests, reserved lands and protected forests in the State. But the State has got about 315,800 ha of unclassified forests, in which shifting cultivation is allowed with the permission of the concerned Collector of the district. In these unclassified forests, *jhum* is the rule rather than any exception. The reserved and protected forests are also being encroached on by the shifting cultivators. The official policy is to vacate such encroachments and punish the offenders. In Tamil Nadu, an adequate area has been set apart, where shifting cultivation is allowed on a 3 to 6 year cycle. Since the number of hill tribes is small, the area affected is small, and in the State shifting cultivation is not recognised as a big problem. In Rajasthan, the practice of shifting cultivation has been totally prohibited under the provisions of Rajasthan Forest Act, 1953. Some tribals have been affected by this prohibitory regulation in Kota, Jhalawar, Udaipur, Banswara and Dungarpur districts.

42.12.12 We would like to keep on record the views on shifting cultivation projected by the Chief Ministers, Ministers of Agriculture and officials of some of the Eastern States of India in their discussions on policy issues, when we visited the concerned States. The Chief Minister of Manipur indicated that introduction of cash crops like potato and maize has increased the intensity of the problem of *jhum*, as the increased income from these crops raised the propensity of the farmers to increase the area under *jhumming*. According to him, the solution to this problem lay in increasing the area under soil conservation measures and resorting to terracing on a more extensive scale and even on slopes which had not been brought under this measure so far. The main constraint in pursuing these programmes on an adequate scale was finance. This would require disforestation of large areas and their conversion into croplands. It was brought to our notice that the problem of *jhumming* had reached the present proportions because of the system of community ownership. In the case of Naga tribes of Manipur, the custom of tribal ownership of the forests was not prevalent and *jhumming* was not as serious as in areas populated by Kuki tribes or Nepali settlements. One point made was that if the shifting cultivator was convinced of the economics of introduction of quick growing forest crops, like walnut and eucalypts, he could perhaps be made to take interest in the growing of these species in the *jhummed* area.

42.12.13 Agriculture Minister of Nagaland opined that the programme of link roads would mitigate the problem of *jhumming* to a great extent, as with the opening up of these areas, farmers would be more prone to make investment in developing their lands for permanent cultivation. The solution projected was conversion of *jhum* sites owned by village communities into permanent cultivation. Since such

conversion costs Rs. 3,000 to Rs. 4,000 per ha, the main problems were the source from which the finance could be available and the extent to which this programme could be subsidised by the Government. Apart from subsidy, it was suggested that the Government could perhaps make the required investment, which would be treated as a long term loan to the beneficiary to be recovered in annual instalments.

42.12.14 In Arunachal Pradesh, it was stated that the evil of shifting cultivation was rampant. Hill tribes might be willing to shift to valley areas or practise terraced cultivation, provided it could be demonstrated to them that it would be profitable to take to permanent cultivation. As the yields from terraces were not high in the initial years, the programme had to be adequately supported during these years. One view projected was that the *taungya* system would not become popular and there should be no disturbance of the existing balanced ecosystem by introducing a new system without giving alternative avenues of employment or income. We should, however, add that shifting cultivation cannot be considered as a balanced part of an ecosystem.

42.12.15 Various schemes for tribal development have been taken up in the country from time to time in order to promote the educational and economic interests of the tribals. Mention should be made of the Central sector programmes of Tribal Development Agency (TDA) and Hill Area Development (HAD) launched towards the latter part of the Fourth Plan in certain selected tribal and hill areas of the country on a pilot basis in order to find out an answer to the problem of continuing economic backwardness of such areas. The TDA was considered as an advancement from the concept of 'extension' and 'welfare' to the concept of 'investment' and 'development'. The strategy adopted for TDA and HAD projects has been an integrated development of agriculture with subsidiary occupations and development of infrastructure. There are 8 TDA projects at present and 2 HAD projects. The TDA projects are located in (a) Srikakulam of Andhra Pradesh, (b) Singhbhum of Bihar, (c) Dantewala, (d) Konta in Bastar district of Madhya Pradesh, (e) Ganjam, (f) Koraput, (g) Keonjhar, and (h) Phulbani of Orissa State. The HAD projects are located in (a) Pauri-Garhwal of Uttar Pradesh and (b) Nungba of Manipur.

42.12.16 Each of the first six TDA projects has an outlay of Rs. 2.00 crores — Rs. 1.50 crores for the core programme of economic development and Rs. 0.50 crores for construction of arterial roads. The other two TDA projects and the HAD projects have an outlay of Rs. 1.50 crores each for the economic programme only. The economic programmes relate to (a) land and water utilisation, like development

of agriculture and horticulture, land development and soil conservation measures, water and power development, settlement of landless families, prevention of shifting cultivation, farm forestry and other afforestation measures; (b) taking up a supporting programme of subsidiary occupations in a selective manner, like cattle development, dairy, piggery, sheep and goat rearing, poultry and duck keeping, fisheries, bee keeping, sericulture and other small and cottage scale rural industries; (c) strengthening the cooperative and marketing infrastructure supplemented by a network of link roads, and in some areas arterial roads; and (d) undertaking debt relief operations specially to free the tribals of their existing burden of debts and to safeguard against alienation of tribal lands and their restoration to the lawful owners in case of such alienations. Out of Rs. 1.50 crores for economic development for each of the projects, only Rs. 4 to 5 lakhs were earmarked as outlay for forestry activities.

42.12.17 In the Fifth Plan, the pilot projects in the Central sector are expected to continue. In addition, Integrated Tribal Development Projects (ITDP) in the State sector will be undertaken in the Fifth Plan. Each State having a sizeable tribal population will prepare a sub-plan for the tribal areas specifically indicating the flow of resources to the tribal areas from different sectors. "Taking into consideration the concentration of tribal population as the criterion, compact areas will be demarcated at the district, *taluk* and block levels. A core programme will be required to be drawn up for providing the basic infrastructure necessary for warehousing, completion of land records and records of rights in forests, debt redemption, development of medium and minor irrigation, provision of improved practices in agriculture and horticulture, tackling the problem of shifting cultivation, establishment of agro- and forest-based processing industries, arterial roads linking tribal *hats* and forests, transport and communication facilities, strengthening of administrative structure, etc."¹

Tribal Development Based on Forests and Control of Shifting Cultivation

42.12.18 In Chapter 41 on Forest Policy, we have stated that both from the point of forest development and economic well-being of the tribals, shifting cultivation should be regulated, contained and replaced as expeditiously as possible, but any such programme should form a part of the wider plan for tribal welfare. Tribal welfare should

¹ Draft Fifth Five Year Plan, 1974-79, Vol. II : p. 275 (paragraph 13.7). New Delhi, Planning Commission, Government of India.

be ensured not only by satisfying their domestic needs from the forests but also by recognising the priority needs for their direct employment in forestry practices.

42.12.19 The main approach to the solution of the problem of shifting cultivation should be by permanently settling the shifting cultivators and weaning them away from the practice of shifting cultivation. Suitable areas in the lower reaches and valley lands and on gentle slopes should be terraced for settled cultivation. To bring about a change from shifting to settled cultivation, it is necessary to see that land formation is properly done and adequate investment is made for facilities like irrigation and inputs like seed, fertiliser, etc. In terracing land for settled cultivation, the following points should particularly be noted :

- (i) Small scale irrigation may have to be arranged from hill streams, preferably by gravity; and hence the physiography should be suitable for taking up the work.
- (ii) Effective extension education would be essential.
- (iii) Terracing is a costly process, and hence should be resorted to only where there is a possibility of continued financing of maintenance and institutional arrangements for irrigation, seed, fertiliser, etc.
- (iv) The land tenure system should be set right. A number of studies show that alienation of land owned by tribals takes place even in areas with good soil and irrigation facilities.

42.12.20 It would be necessary to open fair price shops for assured supply of essential commodities at reasonable rates to the tribals. Restriction would have to be placed on the rights and privileges of the tribals in the collection of forest produce, such as fuelwood and small timber, where lack of such restrictions may damage the forests. The domestic requirement of the tribals in respect of these products, however, must be met through *nistar bhandars* (depots) in the manner explained later in Chapter 45 on Forest Protection and Law.

42.12.21 Settled agriculture should not necessarily be the only guiding policy in regulating shifting cultivation. It may not be possible to have suitable lands for settled agriculture for all the tribal families. If pushed too much, sub-marginal lands may be brought under the plough, or steep slopes converted into permanent cultivated fields, leading to serious problems of erosion and consequent impoverishment of the beneficiaries themselves. Moreover settling all the tribals in fixed agriculture would be a long term process. In North Eastern India alone, there are four lakh tribal families involved in *jhum* at present, and with the increase in population, the number would certainly go up in the near

future. If even 2 ha per family (which may turn out to be uneconomic holdings in the hilly terrain) are allowed, terracing may have to be done over 1 to 1.5 million ha. Apart from the fact that suitable land may not be available to this extent, the capital cost alone may be anything between Rs. 300 to 600 crores. Moreover, the time element involved would be a serious drag in the effective implementation of the programme, and the net effect would be only to create further problems. In view of the above, we are of the opinion that a simultaneous programme would have to be taken up for afforestation through agri-silvicultural methods, pasture and grassland development, introduction of horticulture crops as well as plantation crops like rubber, tea, coffee, etc., providing full time occupation for the tribals in programmes of agri-silviculture, raising plantation crops, development of livestock, etc.

42.12.22 Afforestation through agri-silvicultural methods would meet for a long time to come the psychological urge of the tribals to practise shifting cultivation. Forest corporations, where set up, should assign due weight to this aspect. Where these programmes are taken up, the tribals should be given homestead lands. Pasture and grassland development also should be taken up by the Forest Departments, and areas should be earmarked for the purpose. We should say that generally the lower and middle hill slopes would be suitable for horticultural and plantation crops and the higher slopes for afforestation and pasture and grassland development. As explained in Chapter 41 earlier, direct and sustained employment of the tribals, through cooperatives where possible, should be a responsibility built into the programme. Import of labour should be carefully controlled, so that adequate and sustained employment goes first to all the local tribals.

42.12.23 In some tribal areas, where shifting cultivation is not much in vogue, it may be necessary to take up commercial production forestry programme. For judicious planning of production forestry in tribal belts, the following points should be borne in mind:

- (i) production forestry on commercial lines in tribal belts should be supplemented by a social forestry programme in parts of forests specially earmarked;
- (ii) mixed forestry should be practised by growing grass, fuel trees, fodder species, fruit trees, etc. in the earmarked areas;
- (iii) direct and sustained employment of the tribals should be a responsibility built into the programme;
- (iv) development of minor forest produce (MFP) should be a supplementary, but simultaneous, effort on the lines recommended in Chapter 43; and

- (v) import of labour should be carefully controlled so that adequate and sustained employment goes first to the local tribals. With departmental working in production forestry it would be a relatively easy task.

42.12.24 The commercial production forestry programme would require establishment of wood based and MFP based industries. As regards the impact of industrialisation on the tribals, it has been said in some studies that apart from the immediate effect of displacement, the tribals have to face competition from outsiders for the labour markets when a large industrial complex comes into existence in the heart of tribal areas. But it must be realised that there is a difference between one industry and another. Forest based industries would continuously require forestry operation compatible with tribal traditions and skills and no displacement of any tribal is visualised. Hence we do not apprehend any adverse effect of a forest production programme, provided the points outlined in the paragraph above are well taken care of. Moreover, for absorption in the industries the tribals should be trained, so that dependence on outside labour is further reduced.

42.12.25 It has been recognised that administrative shortcomings are one of the basic weaknesses in tribal development programme: Quraishi¹ states that because of inhospitable conditions and lack of medical and educational facilities the officials and staff posted to tribal belts are reluctant to take up assignments and that mobility in the tribal areas is seriously hampered during the rains. Forest Service is one organisation which has a wide administrative set-up in tribal areas and we are of the view that adequate use of these organisational capacities should be made to tackle the problem of tribal development generally. There should be a multidisciplinary approach and involvement right from the planning stage. The Forest Departments should coordinate all activities concerning the problem of shifting cultivation and a solution should be found through the forest and other production programmes as outlined elsewhere in this section. We would also like to stress that no programme of economic development of the tribals should be formulated or implemented without examining its impact on forest management.

13 SPECIAL PROBLEM AREAS

42.13.1 In Chapter 59 on Special Area Development Programmes, we have indicated briefly the possibilities and need of forest develop-

¹ Quraishi, M. A., 1974 (Oct 1). Tribal Development in the Fifth Plan, Kurukshetra, 22nd Anniversary Number : p. 15, 23(1).

ment in (a) hill areas, (b) tribal areas, (c) arid and semi-arid areas and (d) Kutch and Sundarban areas. Due to the extreme diversity of climatic and edaphic conditions, forest vegetations are widely different in all these areas, and hence the approach to management and silvicultural problems would be vastly different. But most of these areas have been subject to quite extensive forest research and scientific management for quite a long time. However, importance of forestry in a few regions, where special forest problems exist, has recently been recognised, and the problems have been focussed. In this section we deal with two such regions specifically: (a) Andaman & Nicobar Islands and (b) cold desert areas.

Forest Production Programme for Andaman & Nicobar Islands

42.13.2 Andaman & Nicobar Islands are separated from the mainland of India by the vast stretches of the Bay of Bengal. The Andaman group consists of 324 large and small islands covering an area of 6,491 sq km. The Nicobar group consists of 24 islands covering an area of 1,645 sq km, making the total geographical area of the Islands to be 8,136 sq km. About 7,470 sq km are reported to be under the Forest Department's control, and this works out to be more than 90 per cent of the land area in the Islands as under forest. In view of the difficult terrain, remoteness, high degree of inaccessibility, lack of adequate forest organisation and the need to coordinate clearing of forests for various other programmes, a firm programme of forest operation and development has been put into practice. Because of the richness of the tropical forests of the Islands, it should be possible to base the economic development of the Islands on the forest development programmes. In the following few paragraphs, we examine such prospects and give suitable recommendations in this regard.

42.13.3 The vegetations in the Andaman & Nicobar Islands is a luxuriant and almost impenetrable growth of tropical rain forests, characteristic of humid, warm and wet tropical climate. The vegetation becomes more evergreen as one proceeds from north to south, due to an increase in the rainfall. There are also some species (a few of the species generally found in the Islands is listed in Appendix 42.13), which are confined either to the northern islands or to the southern islands; for example, *padauk* does not occur beyond the islands of main Andaman group, and the distribution of *qurjan* is limited only upto Little Andamans.

42.13.4 No detailed survey of forest resources has been done in the Islands. Only 10 per cent enumerations have been carried out in

limited areas of South, Middle and North Andamans for the preparation of a working plan. The Islands were aerially photographed in 1950 by the Surveyor General of India. No reliable statistics of growth are available.

42.13.5 The technique of natural regeneration was evolved locally and is known as Andaman Canopy Lifting Shelterwood System. An area of about 20,260 hectares were reported to have been successfully regenerated naturally upto 1967-68 in the Andaman group of Islands. Man-made forestry has also been practised in the Islands. *Padauk* and other indigenous species, such as *pyinma* (*Lagerstroemia hypoleuca* Kurz, white *chuglam* (*Terminalia procera* Roxb.) and *koko* (*Albizia lebbek* (Linn.) Benth) were raised in the past. Teak was also tried in smaller patches sometimes mixed with *padauk* or *pyinma* or both. The mixed teak plantations were raised in Wemberleygunj in 1908 and 1914. *Padauk* came to dominate teak. Pure teak plantations were introduced again on a regular basis from 1954. Till 1969-70, about 4,540 hectares of land have been brought under plantations of *padauk* and teak, the major portion being under teak.

42.13.6 There are two plywood manufacturing units, one at Bamboo Flat, Port Blair (South Andamans) and the other at Bakultala (Middle Andamans). The total annual installed capacity for intake of play logs at these two factories is only 21,600 tonnes. In addition, there is a veneering unit at Long Island, off Middle Andamans with an annual capacity of intake of veneer logs of 12,000 tonnes only. There is a tendency of the industry to confine to *qurjan* only, though the Port Blair factory is also using a number of matchwood species. The requirements of these factories were mainly met by the supply of departmentally extracted timber by the Forest Department, though recently small coupes have been given out to these factories for working by calling open tenders. It was noted that the factories have machinery capable of producing veneers of 1 mm thickness only. Improved techniques or new machinery to produce thinner veneers have not been put into operation by the industry.

42.13.7 There is only one matchwood factory in the Islands at Port Blair, producing match splints mainly from *papita* (*Pterocymbium tinctorium* (Blanco) Merr.), and to some extent from *bakota* (*Endospermum chinense* Benth.) and *lambapathi* (*Planchonella longipetiolata* (King et Prain) H. J. Lam.). Three other species, *didu* (*Bombax insigne* Wall.), white *dhup* (*Canarium euphyllum* Kurz) and *kadam* (*Anthocephalus chinensis* (Lam.) A. Rich. ex Walp.), are sent to the WIMCO factories in the mainland—Calcutta and Madras. Due to difficulties in transport and shipping, quite a considerable quantity is lost due to deterioration, matchwood logs being perishable. The

factory at Port Blair has taken up experiment for production of match box veneers from some of the local species.

42.13.8 At present, extraction of timber in the Islands is done by a unique combination of elephants, tractors, tramline, towing boats, log carrying crafts and road communication. Timber is felled and logged by manual labour. Then, it is dragged with the help of elephants to the nearest riverside (*ghat*) depot on the bank of a creek or to the terminal head again for taking them to *ghat* depot. Tramlines are operated by elephants, if the distance is short; otherwise they are operated by diesel driven locomotives. At riverside depots, the logs are rafted and towed towards central depots, where logs are sorted out—inferior quality for local consumption and superior quality for transshipment to Howrah (Calcutta) and Madras. During the dry weather tractors are also engaged for dragging of timber, instead of elephants. Where roads are available, the timber is also hauled by motor trucks to the *ghat* depots or straight to the centres of consumption as in the case of local plywood factories.

42.13.9 A few roads have recently come up near areas of settlement. A Grand Trunk Road starting from Chiriatapu at the southern tip of the South Andamans to Port Cornwallis in North Andamans is under construction. The road will pass through Baratang and Middle Andaman islands. Some portions of it in South and Middle Andaman islands and a small portion from Diglipur to Port Cornwallis in North Andamans have already been completed. Extraction works have been taken up by the Forest Department and confined to a distance of 1.5 km or so on either side of the road only, due to the absence of forest feeder roads.

42.13.10 Rafting and towing by motor boats is a common form of transport in sheltered waters to bring them to the central depot. Most of the hardwoods are sinkers, except a few like *padauk* and white *chuglam*. Therefore, matchwood species are used to provide the requisite buoyancy for lifting sinker logs. But since matchwood species are scarce in many areas, the same logs are used over and over again. This also results in loss of matchwood species. In the open seas, the transport to the main sea ports is done in Landing Craft Tanks (LCT) and other vessels.

42.13.11 Mechanisation of forestry operations in the Islands has attracted the attention of various experts who have visited the Islands. The Forest Department has taken some action in this regard. They have employed a number of tractors fitted with winches, logging arches and dozing blades. They have also got one Wyssen skyline crane in operation. There is also one tractor repair shop in Long Island.

42.13.12 Fellings are mostly confined to a few (only about 30) marketable species at present. Even of these species, only logs of 120 cm midgirth in the case of saw logs and ply logs, 95 cm in the case of matchwood logs other than *papita* and 90 cm in case of *papita*, are extracted at present. This also makes the extraction cost heavy, in addition to a very large wastage of forest raw materials. From the limited operations under the present working plans, the annual average outturn of timber is as follows :

South Andamans	38,000 m ³
Middle Andamans	39,000 m ³
North Andamans	8,000 m ³
	<hr/>
	85,000 m ³

From the total production, plywood factories in the Islands utilise on an average 23,000 m³, match factories 4,000 m³ and the Government sawmill 33,000 m³. The remaining quantity is sent to mainland for disposal.

42.13.13 Any step towards the intensification of management would result in large areas being worked and more outturn obtained. Labour being in limited supply, a substantial increase of machinery for road making, forest clearance, transport on land, etc. will be required. Water craft strength would also have to be greatly increased, because there would have to be a few principal ports for export of forest produce and products of forest industries. Facilities at the disposal of the Forest Department for repairs to major water crafts, tractors, etc. would have to be arranged. This will not only require adequately skilled worker, but also other arrangements.

42.13.14 There are no facilities for direct shipping for export to foreign countries from the Islands. Logs and sawn timber not used locally are transported from Port Blair to Calcutta and Madras. The Shipping Corporation of India has put into operation MV SHOMPEN for carrying timber from the Islands in the mainland. This ship carries about 1,400 tonnes in each trip and makes about 10-12 trips a year. But the shipping freight from Port Blair to Calcutta or Madras is about 6 to 7 paise per km, against a Calcutta-London rate of about 2 paise or Calcutta-Japan rate of 3 paise. The crippling freight greatly affects export possibilities.

42.13.15 The present state of forest management in the Islands clearly points out that a very much higher effort in forest operations can, and should, be made. The aspects that need to be properly planned :

- (i) organisation of men and materials ;
- (ii) organisation of utilisation and exports ; and
- (iii) improvements in social conditions of living.

42.13.16 Planning the organisation for forest development in the Andamans & Nicobar Islands would have to follow an assessment of the workload. The existing working plan organisation should be strengthened for preparing a production oriented management plan for forests of South, Middle and North Andamans. A new working plan organisation should also be set up for taking up immediately the initial working plan works for the Little Andamans, Great Nicobar and some other islands in the Nicobar group. Consolidation of the forests of the Andaman group of islands should be taken up first and completed within the Fifth Plan period.

42.13.17 It would not be practicable to aim at a forest development programme covering the total area under forests in the different groups of islands. A few islands must be selected initially for starting the work, and a rational plan for sustained working, setting up of industries, development of infrastructure, power supplies, shipping facilities, etc. should first be drawn up for selected islands.

42.13.18 The stocking in the forests has not been studied in depth. The timber (only the species commercially saleable at present) stocking in North Andamans is estimated to be 40-50 m³/ha (12 to 15 tons per acre), while stocking of such timber in South and Middle Andamans is estimated to be somewhat lower. Preliminary survey of timber resources has indicated 70-85 m³/ha (20-25 tons per acre) of commercial timber in Little Andamans and 35-40 m³/ha (10-12 tons per acre) in Katchal and Great Nicobar Islands in the Nicobar group. According to a recent study, the growing stock in Little Andaman island will be of the order of 160 tonnes per hectare (about 240 m³/ha) out of which 50 tonnes will be commercially saleable (plywood 30 tonnes, matchwood and saw-logs 20 tonnes) and 210 tonnes non-commercial wood. No indicative plan will be realistic, without more dependable statistics. Hence, there is great need for a survey of available resources.

42.13.19 Under a production oriented management plan, renewal of resources cannot be left to chance. Regeneration and tending work would become important and sizeable, and has to be backed by adequate research information on species performance and requirement. Experiences of the mainland are not likely to be of much assistance, nor is there any reliable research data on similar forests in other countries abroad. The forest research organisation in the Islands should, therefore, be strengthened to undertake research, and provide knowledge and information for a production oriented management plan. Equally, industrial and utilisation research would be a crying need. A research centre should be established at Port Blair immediately and by 1980 converted into a fullfledged regional research institute.

42.13.20 The forest organisation should be strengthened at all levels for bringing the forests under more intensive management and for carrying out inventories under the guidance of the national forest survey organisation, which we have suggested to be set up in Chapter 46 on Forest Planning, Research and Education. For logging utilisation and marketing a separate organisation would be required. These works are required to be carried out on commercial principles. As such, a Forest Development Corporation in the Islands should be set up very early, in line with the recommendations in our interim Report on Production Forestry—Man-made Forests.

42.13.21 Apart from the industries and funds, the manual labour problem is also acute, and no logging or management plan will succeed, unless this factor is taken into consideration. According to 1971 census, the density of population in the Andaman & Nicobar Islands is only 14, against the all-India average of 182 (excluding Jammu & Kashmir and Arunachal Pradesh). In the population of the Islands, there are about 650 females for every 1,000 males, against an all-India figure of about 930 females for every 1,000 males. This perhaps is due to the seasonal migration of male labour during the working season (the census reflects the figures as on April 1, 1971). Except for Andhra Pradesh, the percentage of workers in the total population is the highest in the case of the Islands, being 39.39 per cent against all-India average of 33.54 per cent. In spite of this, the availability of labour is scarce. The wage rate structure and labour recruitment is not uniform in the Islands. Labour from the mainland continues to pour into the Islands through private agencies, though the employment is largely in the Government sector. Since there is no surfeit of labour to choose from, any operation solely depending on manual labour would run into difficulties, particularly when the operations, as in the case of forests, are to be carried out in the remote interior.

42.13.22 It is accordingly recommended that the Logging Training Centres Project in Dehra Dun should be associated with preparing logging plans suited to the topography and environmental conditions of the Islands. Keeping in view the fact that an appreciable dependence on imported manual labour is likely to be at the cost of displacing the earmarked population being settled in the Islands, and also the future job requirement of the settled population after the rehabilitation programme is completed, the logging plan should be prepared for dependence to a fair extent on integrated mechanised logging. Importance should be attached for the completion of a logging plan before the proposed corporation starts functioning so that avoidable waste of time may be minimised.

42.13.23 The problem of an integrated development of forests industries in the Andaman & Nicobar Islands needs to be elaborately

worked out. Little Andaman has the potential raw material for starting a saw mill and other wood based industries. Great Nicobar offers similar scope for development but a more thorough investigation on the water potential and supporting infrastructure is required. Before starting new industries, the possibilities of expanding the existing industries, as also the relative advantages of expanding the existing industries as against starting new ones, need to be worked out. In the long run, the question of agency, type of industries to be set up and the alternate policies regarding starting of new industries *vis-a-vis* expansion of existing industries needs to be resolved. The shipping and export constraint of finished products needs also to be worked out.

42.13.24 For an integrated approach to planning for forest development and forest industries, locations should be carefully selected so that these locations become the focal points of growth in the economy of the Islands. There is only one urban area in the Islands—Port Blair. It should be possible to establish several urban areas gradually, centred round forest operations, wood based industries, port facilities, repair shops, etc.

42.13.25 It is also recommended that a Planning and Project Formulation Cell should be established under the Chief Conservator of Forests immediately, so that the planning of chosen existing and new industries can also start simultaneously. The industries should be chosen with an eye to export of processed products to foreign countries.

42.13.26 Arrangements should be made for direct shipping of forest products for export to foreign countries from the Andaman & Nicobar Islands, for which port and loading facilities should be developed in the focal points of growth to be selected for forest and forest industries development. This should remove one constraint for export oriented forest industries, and also encourage the existing mills to modify their technologies for efficient and profitable working. Hydrological survey should be undertaken to find out the availability of fresh water, and its surplus for industrial use, in the growth centres to be selected for forest development.

42.13.27 No progress in development of forests, forest based industries and export of forest products can be expected, unless the improvement of anchorage and loading facilities is done at the different growth centres. The present facilities available and the programme of improvement of jetties are given in Appendix 42.14. It will be seen that in many ports the loading has to be in stream. Moreover, shipping is possible for a few months in a year only, as the sea remains rough at other times. The Shipping Corporation of India wants a minimum load of 700 to 800 tonnes per trip and loading within a maximum of 36 hours to be arranged. This expectation is not very unreasonable.

42.13.28 Improvement in anchorage facilities should be continued in the ports as outlets from the selected growth centres. In the meantime, the Forest Department should acquire a sufficient number of barges for loading in stream, and the organisation should be so set up as to make it possible to load 700 to 800 tonnes within a maximum period of 36 hours. Dry docking facilities should also be provided at ports in North Andaman, Little Andaman and Great Nicobar islands. Mechanisation of felling and transport and a more efficient system of water transport should be evolved. It may be mentioned that some countries like Norway has also to work their forests in difficult terrain involving a large volume of water transport. Know-how and expertise from such countries can perhaps be easily arranged on acceptable terms.

42.13.29 It is also recommended that a study team of the Government of India (from the organisation of the Inspector General of Forests, Ministry of Agriculture & Irrigation) should visit Malaysia and Indonesia to get information about the methods and facilities of loading and stowage of roundwood, sawnwood and woodchips for export.

42.13.30 Since the development of forestry in the Islands, as well as of other areas of developments, like power, roads, etc., would be on a planned basis, it should be possible to plan the manpower requirements. Practically, the entire new demand of skilled labour would have to be met by import of such labourers from the mainland. Unskilled categories of labour also will have to be imported. But it should be possible to analyse how many of the employment-seekers from the settler population can be trained for skilled jobs in future years. Similarly an assessment is also possible about the total number of unskilled labour that may come to the employment market from amongst the settler population in the coming years. The importation of skilled and unskilled labour should be related to such an assessment and not allowed indiscriminately.

42.13.31 It is seen from 1971 census figures, that the population in the Andaman & Nicobar Islands rose to 150,090 which represented a decennial growth rate of population between 1961-1971 of 81.11 per cent. For the accelerated development of the Islands, a very high growth rate of population through importation may be expected in the decade 1971-81. Another remarkable feature of the population in the Islands is that the percentage of literates to total population was 33.63 per cent in 1961 and it rose to 43.8 per cent in 1971, very much above the all-India average of 29.34 per cent in 1971. Demographic projections of the population should be made after taking the projected development works and the above factors into consideration.

42.13.32 It is, therefore, recommended that while the type and quality of labour to be imported from the mainland should be regulated and tied to different development programmes, the Andaman Administration should introduce training schemes for generating skills in the prospective employees of the settler population, so that the skills are matched to the exact requirement of development. The Andaman Administration should take up a programme for increased local production of foodgrains, dairy products and meat products, so that spiralling of labour and other costs may be prevented and the cost of industrial production maintained at a reasonable level.

42.13.33 Amongst the Government employees the Forest Department has the largest strength of permanent staff in the Islands. These employees face the prospect of spending most of their life in the Islands. Until social and other amenities substantially improve, such a prospect is not likely to create enthusiasm amongst the serving officers. In fact the desire to seek a posting on the mainland is frequently exhibited in most of the individuals. A solution to this problem must be found as no development is possible unless implemented through a band of capable and enthusiastic personnel.

42.13.34 A joint cadre of Indian Forest Service (IFS) for the Union Territories was expected to bring relief to the officers stagnating in the Islands for many years. But inter-transfer between the mainland and Island territories has not been to an extent to bring relief to the officers in the Islands. It is recommended that a mainland posting of forestry personnel in the professional grade may be alternated with a posting on the Islands. If this does not work satisfactorily, the possibility may be considered of the distribution of the Island cadre to some of the mainland States for the purpose of a frequent exchange of postings and induction of a fresh outlook on forest management.

42.13.35 The salary scale of the serving officers has to be considered with reference to the cost of living. With the formation of the IFS, some uniformity in the pay scales and allowances has been brought in. But the isolation, hardship and very high cost of living, including the cost of double or more establishments to be maintained by senior officers, must be reflected in the salaries. The same consideration should apply to the personnel in the sub-professional (Forest Rangers) and technical (Foresters) grades. It is, therefore, recommended that a substantial increase of allowances for posting in the Andamans & Nicobar Islands should be approved by the Government. Moreover, for running the public sector industries and logging operations, employment of retired defence services officers should be considered.

42.13.36 The headquarters of the forest staff will, necessarily have to be located in selected growth centres. The actual work will be confined to a few months in the year, because of the heavy monsoon. Such works should be organised from well selected camps. An atmosphere should be created so that the personnel have a chance of freshening their minds after the monotony and lonely life in the camps by being able to have contact with personnel in other disciplines at other times. One way would be to disperse the headquarters of different departments, including the Indian Navy, to a few selected growth centres, and developing the latter in a planned way.

42.13.37 It is recommended that building and other amenities should be constructed in a planned way in the selected growth centres, which, to start with, should be one each in the North Andaman, Middle Andaman, Little Andaman, Great Nicobar and Katchal islands, in addition to Port Blair—Chatham complex. The headquarters of the Forest and other Departments should be suitably dispersed in the centres, where compact social and recreational facilities should be provided.

Cold Desert Areas

42.13.38 Cold arid areas occur in the Ladakh region of Jammu & Kashmir, and Lahaul and Spiti region and Hangrang Valley of Himachal Pradesh. Lack of vegetation is caused by deficiency of water, absence of agriculture for all practical purposes, and a sparse and nomadic population depending mostly on animals for their livelihood. An essential part of the development of cold deserts is the provision of an adequate quantity of fuelwood and fodder, and that is why we have taken a look at the forestry problems and situations in such deserts in this section.

42.13.39 In the cold desert of Ladakh region, two distinct bioclimates can be recognised¹, namely cold and cold temperate. Based on Gaussen's classification, these are: (a) eremic (desertic) climate of Leh, and (b) hemi-eremic (sub-desertic) climate around Kargil.¹ The dryness is of two kinds in this region, also in the case of Lahaul and Spiti region of Himachal Pradesh, one caused by low temperature (below 0°C) inhibiting the absorption of water by the plant roots, and the other caused by the dryness of the atmosphere. In the eremic class (around Leh), the temperature is below 0°C from November to March (5 months). This is followed by a dry period of 7 months (April to October) with temperatures above zero. If there be sufficient winter snow, abundant moisture would be available during the melting period of snow. Thus April cannot be considered as dry, although the moisture available owing to snow melt is not of much

¹ Kaul, R. N., 1965. Afforestation in the Cold Desert of India, Ind. For., Vol. 91(1).

significance to plant growth due to the fairly low temperature (less than 10°C) prevalent during the month. In the hemi-eremic class (met around Kargil in the valley), the total precipitation in the dry and cold months is 9 to 10 mm. The cold period extends from November to March and dry period from May to October. May and June can be considered as comparatively wet months due to the melting of snow. From the view-point of thermal regime conducive to plant growth, the growing season both for Leh (3 months, extending from mid-June to mid-September) and Kargil (5 months, i.e. from mid-March to mid-September) falls during the dry period, thereby indicating that all attempts to grow any kind of vegetation particularly trees will entirely depend on the availability of irrigation and that growth of plants has of necessity to be slow due to the extremely short growing season. The altitude of Leh is 3,516 m and of Kargil 2,333 m.

42.13.40 In the Lahaul and Spiti region and Hangrang Valley of Himachal Pradesh, there are some pockets where general desert conditions find a change either due to the melting of snows in some depressions or the occasional escape of monsoon winds causing mild showers. In such cases *kail* and birch (*Betula utilis* D. Don) are found. The altitude in Lahaul and Spiti region varies from 2,743 m to 6,401 m and in Hangrang valley from 3,109 m to 6,791 m, between latitudes 30°-45' to 33°-10'N and longitudes 76°-46' to 78°-47'E. Apart from eremic (areas lying above 4,200 m) and hemi-eremic types of desert climate, there are some areas (above 4,800 m elevation) which remain covered with snow for a greater period of the year and the temperature is below 0°C all the year round.

42.13.41 Generally speaking, natural vegetation belongs to the following broad forest types, according to Champion and Seth's classification :

(i) 15/C 1	Birch—Rhododendron Scrub;
(ii) 15/C 2	Deciduous Alpine scrub;
(iii) 15/C2/E1	Dwarf Rhododendron Scrub;
(iv) 15/C 3	Alpine Pasture;
(v) 16/C 1	Dry Alpine Scrub; and
(vi) 16/E 1	Dwarf Juniper Scrub.

Actually, however, no tree vegetation worth the name is found in the cold desert region. The region appears to carry only about a dozen endemic plant genera, mostly small and specialised. Halophytes and xerophytes are well represented, and Kaul¹ found that in the Ladakh region more than a third of the total number of genera belong to Cruciferae, a family of notoriously difficult generic distribution. Chenopodiaceae and Umbelliferae are also well represented.

¹ Kaul, R. N., 1965. Afforestation in the Cold Desert of India, Ind. For., Vol. 91(1).

42.13.42 Among the woody shrubs and trees, indigenous and 'introduced', which are of special significance to the local populace for meeting their requirements of fodder, fuel and small timber, mention may be made of the following: *Salix elegans* Wall., *S. alba* Linn., *S. selerophylla* Anderss., *S. fragilis* Linn., *Populus alba* Linn., *P. euphratica* Oliv., *P. candicans* Lodd ex Loud., *P. nigra* Linn., *P. ciliata* Wall., *P. angustifolia* Fanes, *Juniperus polycarpus* C. Koch. *J. communis* Linn., *Astragalus* spp, *Artemesia* spp, *Nitraria schoberi* Linn., *Myricaria bracteata* Royle, *Hippophae rhamnoides* Linn., *Rosa webbiana* Wall., *Tamarix Gallica* Linn., *Elaeagnus angustifolia* Linn., *Caragana pyomea* DC., *Haloxylon thomsoni* Bunge, *Eurotia ceratoides* C.A. Mey., *Ephedra vulgaris* Hook.f. non A. Rich., *Atriplex crassifolia* C.A. Mey. Some rhododendrons also occur in the Lahaul-Spiti and Hangrang valley. Besides the above, some of the other important undergrowth are: *Crataegus oxyacantha* Linn., *Viburnum foetens* Dene., *Fraxinus zanthoxyloides* Wall., *Berberis vulgaris* Linn., *Filipendula kamtschatica* Maxim, *Lonicera* spp, *Eremurus spectabilis* Biob., *Caltha palustris* Linn., *Cuminum cyminum* Linn., *Ligularia arnicoides* Wall, etc. Irrigated plantations mostly of poplars and willows have been done to meet the requirements of fuel and timber for the local population. The important plants yielding minor forest produce are: *Ephedra gerardiana* Wall., *Artemesia* sp., *Podophyllum emodi* Wall. ex Hook.f. & Th., etc.

42.13.43 The population is sparse in Lahaul-Spiti region — about 2 persons per sq km. But the vegetation is equally sparse Digging of *Ephedra*, *Rose*, *Artemesia*, *Hyppophae* and other bushes is done as a normal practice to meet the requirement of fuel. Paucity of vegetative cover together with high mean wind velocity (22 km/hr) in some seasons are responsible for extensive wind erosion in the region. But the digging of the bushes cannot be prevented without making suitable programme for growing fuel and fodder locally. Modest attempts are going on for raising plantations in the region. Since raising of plantations is possible only with irrigation, plantations are restricted to areas that can be connected to a river system by means of ditches to irrigate each and every plant.

42.13.44 In the Ladakh area, the plantations were started in 1956-57, and the total area planted so far is little over 2,100 ha. Two-thirds of the above area were planted in the first 10 years. Survival percentage was recently estimated to be 38 per cent. But with experience, plantation techniques have improved and the survival in recent plantations is 70-90 per cent. The most common species are poplars, willows, *Hippophae* and *Myricaria*. Attempts have also been made to propagate black locust (*Robinia pseud-acacia* Linn.), walnut (*Juglans regia* Linn.), horse chestnut (*Aesculus indica* colebr.), and it

is found that these species can be successfully grown in Kargil, Nubra and Leh areas, provided irrigation is abundantly available. It is estimated that for fuelwood supply *Hippophae* and *Myricaria* can be worked on a 10 year rotation with an yield of 5 tonnes/ha, and willow between 20 to 40 years with an expected yield of 30 tonnes/ha. Poplar is recognised as a timber species and the anticipated rotation is 30 years. Planting at spacings of 3.6 m \times 1.8 m costs about Rs. 2,000 per ha, excluding overhead charges. It is reported that all suitable areas under command of the existing irrigation system have been afforested.

42.13.45 In the Lahaul-Spiti area, the oldest plantation may be taken to be 60 years of age. The old trees are found to be getting rotten and drying, because of repeated lopping and pollarding. These plantations are not worked on any scientific system of management. The branches and stems down to 10 cm in diameter are lopped/pollarded every third year for fodder, fuel and small timber. Planting of poplars and willows in groups and in lines along irrigation channels and near habitation is a standard practice adopted all over the tract. Sowing of junipers was done in Lahaul but with poor results. The cost of raising plantations is about Rs. 2,000 per ha and so far about 400 ha of plantations have been raised. The high cost is generally due to the fact that irrigation channels are invariably damaged during winter and have to be almost reconstructed every year in summer months. There is also a practice of spreading irrigation water over some areas to induce the growth of grasses and arable crops.

42.13.46 Future forest development activities, to include afforestation, minor forest produce development and range management, can be carried out over limited areas only, and should be taken up with the active involvement of the local population, mainly to meet their requirements of fuel, fodder and small timber. Land availability will be no limiting factor. Even if finance is no limitation, the difficulties of irrigation and labour will remain. However, the scale of operation can, and should, be substantially extended. At present hardly 200 ha are taken up annually for forest development, but there may be no difficulty in bringing it up to 2,000 ha annually.

42.13.47 Range management and grassland development should be an important part of the programme. The local people are not migratory, and hence provision of improved fodder should have the utmost priority for the local livestock. Natural grassland are not abundantly available in the region. The extremes of climate and high altitude also limit their choice. For any large scale programme, pastures will have to be raised artificially where irrigation is available. In summer, graziers from outside migrate to the area with their livestock and cause destruction of natural vegetation. It will be necessary to

regulate the entry of such migratory graziers strictly in accordance with the carrying capacity of the grazing runs.

42.13.48 For a large scale afforestation and pasture development programme, a separate canal system with field channels should be constructed. Adequate funds should be allocated for the purpose separately. The cost for developing 2,000 ha annually at Rs. 2,000 per ha at 1972-73 prices will be Rs. 40 lakhs. To this should be added another 40 per cent for a strong research support and an adequate administrative organisation. The organisation should be built up on the lines recommended in our Interim Report on Social Forestry. At present, even the normal forest administrative structure is very weak. In each of the area — Ladakh and Lahaul-Spiti — creation of a forest circle with 3 to 4 forest divisions seems called for to make a start of a massive programme of afforestation, fodder and grassland development and development of minor forest produce.

42.13.49 Even though the existing techniques and accepted species show only a moderate growth rate, indiscriminate introduction of species not yet tried successfully should not be made, unless supported by an intensive research effort. Research should be taken up immediately on improvement of alpine pastures, introduction of legumes like *Medicago*, identification of deep rooted quick growing hardy species suitable for fuel and fodder, etc. At present *Hippophae rhamnoides* is mainly chosen for areas where availability of irrigation water is less, whereas willows and poplars are planted on sides of irrigation channels and where water availability is more. There is one plant in the area, *Haloxylon*, one of the species of which had been found to be ideally suited to be grown for fuel and fodder in the central Asian cold desert after experimentation by the forest research institute at Tashkent in USSR. Since conservation and best utilisation of available water resources is very necessary, it is expected that experimentation in this regard will be taken up by the concerned agricultural development department and its findings would be also available to the forestry personnel for optimum utilisation of water resource.

42.13.50 The principal objectives of forest research in the cold desert regions should be the following:

- (i) Identification of areas for pasture development and growing of forest trees to provide fodder for the grazing animals, small timber and fuel for the local population, and stabilisation of areas threatened with erosion.
- (ii) Selection of suitable indigenous and exotic species and testing their performance.
- (iii) Ecological and physiological studies in relation to photosynthesis and respiration at high elevation.

- (iv) Studies of socio-economic aspects in relation to rangelands, soil and water conservation.
- (v) Study of the effect of shelter-belts and wind-breaks against high velocity wind.

We recommend that the Government of India should set up a centre for forest research on cold desert at Leh (Ladakh) with an experimental station under it in the Lahaul-Spiti area. This is in line with our recommendations in our Interim Report on Forest Research and Education.

14 ORGANISATION AND MANPOWER

42.14.1 Organisation has to be remoulded or strengthened for implementing the development programmes recommended in the earlier sections of this chapter. A pre-requisite is the availability of manpower with appropriate training and background. For planning and forest research and education, we have elaborated our suggestions in Chapter 46 on Forest Planning, Research and Education. The type of organisation necessary for wildlife management has been indicated in Chapter 44 on Forest Ecology and wildlife Management. In this chapter we deal with the principles that should primarily guide the set-up at different levels, and shall be looking into the magnitude of the professional and technical training requirement. In the previous Chapter on Forest Policy, we have emphasised the need for rational manpower planning by the Centre and the States, considering that it takes a long time to train and deploy a forester. We have also stressed the need for coordination of all forestry and forest industries activities.

Background and Principles

42.14.2 The Estimates Committee (1968-69) of the Fourth Lok Sabha in its Seventy-Sixth Report made some suggestions with regard to the extent of Central responsibility and administrative set-up at the Union level. The Committee on Tribal Economy in Forest Areas in the Department of Education and Social Welfare, Government of India, constituted in 1967 under the chairmanship of Shri Hari Singh, recommended that the improvement of the material well-being of the tribals resident in the forest should be one of the guiding principles of forest management, and as such changes in the organisation and forest management should be made with this in view.

42.14.3 Institutional changes in forest administration and personnel management have been recommended in our Interim Reports

on Production Forestry — Man-made Forests, Social Forestry and Forest Research and Education. We have made references to these suggestions in Sections 3 and 9 of this chapter and in Chapter 46. Organisational changes have also been suggested for executing grass-land development programmes in our Interim Report on Desert Development. In this connection, the following points about forest administration deserve mention¹:

- (i) forest lands possess a distinctive character and pose specific complex technical and managerial requirements;
- (ii) forest Services, unlike the other Government Services in the allied fields in agriculture, directly manage a resource which often covers vast areas and which often has a long gestation period; and
- (iii) forestry is primarily a business, the administration of which differs from that of other Government organisations which merely provide services.

Moreover in our country almost all the forests are State-owned and hence administration is entirely the concern of the Government. In today's socio-economic environment, forests should be developed as resources to be managed in a businesslike way in order that an optimum production of goods and services at economic costs is secured. A forest officer should therefore also have an understanding of, and training in, business management techniques. He must be able to take decisions on the analysis of the data and information at his disposal. He must know how to develop alternative solutions, to set goals, to check on performances and to evaluate results. Put in another way, the task of the modern forester is to determine what goals should and can be achieved, where they can be accomplished, who are the best persons to be assigned for the necessary duties, the methods that should be employed and the time within which they should be performed.

42.14.4 In our view the following criteria should be adopted for the administrative set-up for forestry:

- (i) Whenever possible an elaborate hierarchy should not be built up. For instance, if for the nationalisation of trade in, or departmental working of, any particular produce, it is required to entrust the job to a sufficiently high responsible level, for example a Conservator of Forests, it should not necessarily follow that under him there should be a chain of Deputy Conservators, Assistant Conservators, Forest Rangers, Deputy Rangers/Foresters and Forest Guards.

¹ Kink, K. F. S., 1972. A Summary of the Revised FAO Study on Forest Policy. Law & Administration. Rome, FAO.

- (ii) As a corollary to the first, in jobs requiring a particular expertise, the set-up should be such that there is no scope for passing on the work to others below. For instance, in photo-interpretation there need be no whole army of Technical Assistants, senior or junior. If the workload demands, more photo-interpretation officers of the same status could be appointed.
- (iii) Expertise for different disciplines of forestry should be built up through proper selection, specialisation and training, without losing as far as possible a broad contact with other aspects of forest management.
- (iv) As a corollary to the third, personnel management policy should be such that the expertise is continuously utilised through a change in procedure for deployment of personnel, promotion from grade to grade, etc.
- (v) The set-up should be such that an integrated approach to production forestry and utilisation of resulting produce in forest based industries is possible.
- (vi) The structure should be such that involvement of the local people is possible to secure their cooperation for forest protection from illegal felling and excessive grazing and for securing social justice.
- (vii) The Services must be field oriented and there should be a high ratio of technically qualified persons to non-technical supporting staff.

Formulation of Policy

42.14.5 The Centre-State coordination and relationship in the field of forestry has evolved ideally through the institution of the Central Board of Forestry (CBF) and its Standing Committee, the constitution and functions of which have been given by us in Appendix 41.2 in the previous Chapter on Forest Policy. Though the CBF has been making an effective contribution to ensuring an all-India approach to forest development and to resolving Centre-State and inter-State problems, the meetings of the CBF have not been held regularly in the past. It is mentioned in the order constituting the CBF that its meetings are to be held annually. The Estimates Committee referred to earlier had also adversely commented on the irregularity of the meetings of the CBF. However, we consider one year too short a time for the CBF's recommendations to reach the States, for the latter to examine them and to act on them, and then for a meaningful discourse to take place the next year in a full CBF meeting. Moreover, the Standing Committee, where a more intimate discussion is possible, would then be

virtually reduced to a non-entity. We, therefore, recommend that the Central Board of Forestry should regularly meet every two years and its Standing Committee more frequently. The Standing Committee of the CBF is to assess the progress in the implementation of its recommendations. We feel that the institution of the Standing Committee could be more effectively used. It should be necessary to provide strong technical, administrative and secretarial support to the CBF and its Standing Committee through the Central Forestry Commission (CFC) to enable them to function regularly and effectively. The CFC was constituted in 1965 as a technical sub-committee for servicing the CBF. We have examined its composition and functions (Appendix 42.15), and we are in agreement with the functions assigned to it, except that function numbers (v) and (vii) should in future be assigned to the national forest survey and planning cell organisation respectively to be set up under an Additional IGF. The CFC must meet once in three months as provided in the Government Resolutions. The strength of the CFC should be augmented, so that it can function effectively as a permanent coordinating body at the professional and technical level, in addition to providing the necessary support to the CBF and the Standing Committee.

Forest Administration at the Centre

42.14.6 At present the forest organisation at the Centre is headed by the Inspector General of Forests (IGF). To assist him, there are Deputy IGF's, Assistant IGF's and Secretary, Central Forestry Commission. In addition, there is a Director, Project Tiger, and a Deputy Secretary who is also the Director under the Wildlife (Preservation) Act 1972 and Member Secretary of the Indian Board for Wildlife. The IGF has been given the status of an ex-officio Additional Secretary to the Government of India. For reasons elaborated in Chapter 62 on Administration, we have recommended that there should be a full-fledged Department of Forests in the Ministry of Agriculture & Irrigation, with the IGF as the Secretary in-charge of the Department.

42.14.7 The Department should have Divisions with clearly defined functions. As elaborated later in Chapters 44 and 46, there should be three Divisions as follows, each in-charge of an Additional Inspector General of Forests:

- (i) Division of Forest Inventory, Planning and Evaluation under the charge of an Additional IGF with two wings under him:
(a) National Forest Survey and (b) Planning Cell.
- (ii) Division of Wildlife under an Additional IGF for implementation of Wildlife (Preservation) Act 1972, development

of tourism based on wildlife and national parks and implementation of special projects like Project Tiger.

- (iii) Division of Forest Research and Education under the charge of an Additional IGF to service the Council of Forest Research and Education (CFRE), with three wings: (a) Wing of Forestry, Forest Biology, Forest Management and Operations Researches, (b) Wing of Industrial and Utilisation Researches, and (c) Wing of Forest Education and Training.

In order that the Divisions can function with the greatest flexibilities, the Additional IGF's should be made Additional Secretaries to the Government of India.

Forest Administration in the States

42.14.8 The staffing pattern of the Forest Department consists of a five-tier hierarchy with the Chief Conservator of Forests at the apex. The State is divided into circles held by Conservators of Forests, the circles are sub-divided into divisions held by Divisional Forest Officers, the divisions into ranges held by Range Forest Officers or Forest Rangers; the ranges into beats held by Forest Guards, the lowest cadre of forest officers as defined in the rules under the Forest Act. Four or five beats are grouped into a round in charge of a Deputy Range Officer or Forester. This is the general pattern of the set-up, with local variations in the matter of designations and in the extent of territorial jurisdiction depending on the intensity of management. Functionally, the Forest Guard is charged with the protection of the forest in the beat, the Deputy Ranger/Forester with the protection of the forests and execution of works in the round, the Range Forest Officer with the overall management of the forests in the range, and the Divisional Forest Officer with the overall administration of the forests in the division. The Conservator of Forests is at the intermediate level and serves as an adviser and guide to the Divisional Forest Officers and ensures proper implementation of the policy of the Government and the management and development plans sanctioned from time to time. The Chief Conservator of Forests acts as a technical adviser to the Government in formulating policy on scientific lines and as a chief administrator in forestry matters.

42.14.9 In course of time, special divisions were created for silvicultural research, working plans, forest utilisation, soil conservation, etc. But no opportunities were provided for specialisation either in the research institutes or in the States. The posts of specialists were filled up from the general cadre, with frequent transfers back to the general cadre. At present, depending on the workload functional

posts of Chief Conservators and Conservators of Forests are created for development, nationalisation, wildlife, etc. The jurisdiction of circles, divisions and ranges are reduced wherever the workload increases. On account of increase in population and consequent pressure on land, forest offences also registered an increase and to cope with it the jurisdictions of the beats often come to be reduced. Special divisions were created, where concentrated specialised attention was required, i.e. plantation division, logging division, saw mill division, resource survey division, flying squad division, etc.

42.14.10 For reasons elaborated later in Chapter 62 on Administration, we have recommended that the Chief Conservator of Forests (CCF) should function as Secretary to the Government. Where there are more than one CCF in a State, the principal CCF should be accorded that status. The forest resources of the different States vary widely, and the problems are also different. There cannot thus be any uniform pattern that can be suggested for the administrative set-up in the Forest Departments in different States. An adequate organisational support with personnel of appropriate status in-charge should be built up so that the programmes of production forestry, social forestry, development of minor forest produce, management of wildlife and national parks, forest protection, forest inventory, planning and evaluation, and forest research and training can be properly implemented.

42.14.11 At the level of Conservators of Forests (CF), there should be more field inspections and guidance in the matter of scientific and technical decisions. For this purpose, the workload of each Conservator should be properly assessed. It is expected that a territorial CF inspects representative areas where various types of silvicultural operations are being done (soil working, sowing, weeding, shrub-cutting, climber-cutting, clearing, spacing, thinning, canopy manipulation, understorey control, markings of all kinds) and accord necessary guidance when required; that he inspects felling lots; that he inspects most of the road and building works and in general give guidance in the field in all respects. Since expertise is to be built and utilised in such a way that functional CF's are scientifically and technically qualified for the function, there should be no difficulty about proper field direction, be they in research, planning, inventory, survey, soil conservation, wildlife management, etc.

42.14.12 When commercial forestry is executed on a project basis, the State forest corporation should take over the entire responsibility from protection to utilisation of the produce from the project area. This would need re-adjustment of the charges of the territorial CF's.

42.14.13 A forest division is actually the lowest accounting and administrative unit in the country. As per latest statistics¹, there are 445 territorial forest divisions. With an area of 71.56 million hectares under the control of the Forest Departments, the average size of a division is about 160,810 hectares. On the basis of land utilisation statistics figure of 66 million ha of area under forests, the average size of a division is about 150,000 hectares. In Sweden, where gradual emphasis is shifting to monoculture, the divisional charge may approximate 7,500 to 10,000 hectares. In West Germany, the 'Forestamts' (forest districts) generally headed by university-trained professional foresters range in size from 2,500 to 5,000 ha depending on the workload.

42.14.14 Maharashtra and Uttar Pradesh have prescribed some yardsticks for intensive management of forests — prescribing the workload of a forest division and other arrangements below it. The intensity of management was sought to be correlated to competent personnel per unit area of managed productive forests, the extent of managed unit being inversely proportional to the degree of intensity of management. The norms prescribed in the two States are reproduced in Appendix 42.16. While in Maharashtra, the combined index would be the criterion for splitting a forest division, in Uttar Pradesh the highest index on any one of the criteria prescribed could form the basis for splitting. Another important aspect where the Uttar Pradesh norms differ from those in Maharashtra is the suggestion to create the posts of Sub-Divisional Officers in a division, instead of having gazetted assistants only in the division.

42.14.15 We recommend that each State should set up a committee under the Chief Conservator of Forests to fix up norms for delimiting circles, divisions, sub-divisions, ranges, etc. both for territorial and non-territorial charges. This should take into account the special functions of planning, utilisation, wildlife management, research and education, etc. Care should be taken that in arranging such functions as departmental logging, soil conservation, production forestry project through forest corporations, etc. the same physical forest area does not have more than one agency or authority executing similar types of works there. We visualise that by 2000 AD, the average size of a territorial forest division (or corresponding charges under forest corporations) would not exceed 50,000 ha, so that the forest development programmes outlined by us could be effectively implemented.

¹ 1973. Organisation of Forest Departments : pp 1-32. Bulletin No. 7 (Revision No. 2). New Delhi, Central Forestry Commission, Ministry of Agriculture & Irrigation, Government of India.

Personnel Requirement in Different Forest Services

42.14.16 The hierarchy in forest management has been built up through recruitment to the following well-established Services:

- (i) Indian Forest Service
- (ii) State Forest Services
- (iii) Forest Rangers
- (iv) Deputy Rangers/Foresters
- (v) Forest Guards

We have dealt with the aspect of in-service education and training for the different Services in our Interim Report on Forest Research and Education as also in Chapter 46 on Forest Planning, Research and Education.

42.14.17 We have mentioned in the previous chapter that the Third Five Year Plan laid special emphasis on measures to meet the long term requirements of the country and to ensure more economic and efficient utilisation of the valuable forest products. Towards the end of the Third Plan, the scheme of raising quick growing species was introduced. As a result of more emphasis being placed on production from forests, the requirement of staff has increased considerably in the last 10 years or so. Table 42.10 below shows the total number of forestry personnel in position in 1961 and 1972:

TABLE 42.10
Total Number of Forestry Personnel in Position, 1961 and 1972

Category	1961 ¹	1972
higher professional staff from Assistant Conservators upwards	975	2,267
Forest Rangers and Deputy Rangers	3,939	6,958
Foresters and Supervisors	8,837	18,189
Forest Guards	37,359	53,942
Game Keepers and others	**	12,444
total	51,110	93,800

42.14.18 It would be seen that there was a compound rate of 5.7 per cent in the growth of total personnel requirement in the forest Services. The relative rise in the higher professional staff was the highest,

¹ 1961. One Hundred Years of Indian Forestry, Col II : p 278 (Table XVIII). Dehra Dun, Forest Research Institute.

² 1974. Progress Report 1966-72 by the Ministry of Agriculture, Government of India. Prepared for the Tenth Commonwealth Forestry Conference.

** Presumably included under 'Foresters and Supervisors'.

i.e. 8.0 per cent, and that for the lowest cadre of forestry personnel, i.e. Forest Guards, only 3.4 per cent. The rate of increase in the requirement of Forest Rangers and Deputy Rangers and Foresters was higher than that of Forest Guards. This trend is welcome, because the level of competence at the lower rungs of forest administration has to be raised in order that forest development programmes are properly understood and implemented. For actual work and protection etc., there should be more dependence on rural labour, *panchayats*, etc. With the decrease in the extent of territorial charges and intensification of work through forest corporations, more functional posts would be required for research, training, inventory, planning, social forestry, wildlife management, etc. In our opinion, therefore, the requirement in future years of higher professional staff, Forest Rangers, Deputy Rangers/Foresters, Supervisors, Game Wardens, Game Keepers, etc., should be projected at 6 per cent compound rate of growth. This would be consistent with the average size of a territorial forest division that we have visualised. For Forest Guards, the projection should be at the rate of 3 per cent only. A greater number of educated unemployed would thus find employment in different forest Services, particularly in the lower categories. The projected requirement of forestry personnel in different categories is given in the following table :

TABLE 42.11
Projected Requirement of Forestry Personnel

Category	Staff in position in 1972	Projected requirement			
		1980	1985	1990	2000
higher professional staff	2,267	3,400	4,550	6,100	11,000
Forest Rangers and Deputy Rangers	6,958	10,450	14,060	18,750	33,550
Foresters	18,189	27,350	36,600	49,000	87,700
Forest Guards	53,942	66,300	76,900	89,150	119,850
Game Keepers and others	12,444	18,700	25,050	33,500	60,000
total	93,800	126,200	157,100	196,500	312,100

42.14.19 Since it takes a number of years between the recruitment of a person and the availability of his service in the field, after taking into account not only the time required for education and training in the Central and State institutions but also the time taken for field experience during the probationary period, the augmentation of the education

and training facilities based on the above projections should be planned somewhat ahead of the period in which the personnel are required to be in position.

Rural Employment in Forestry

42.14.20 Forestry is an important source of employment in the rural areas. The employment offered in this sector is often in the off-season for crop production and is, therefore, complementary to the employment in farm production. For instance, logging is generally carried out in the lean agricultural months. Secondly, as forests are located in backward areas, direct employment in forestry activities can benefit the backward communities such as tribals. Besides, activities in the forestry sector require a very high component of unskilled labour and, therefore, would benefit primarily the unemployed and underemployed agricultural labourers and weaker sections of the rural community. However, it should be borne in mind that the employment in forestry should be considered as alleviating seasonal unemployment and/or underemployment, and contributing to an increase in the income level of rural households, rather than be projected as full-time employment for a certain number of persons.

42.14.21 We have outlined mainly the programmes of production and social forestry in this chapter. In the next Chapter 43 on Minor Forest Produce, we have discussed the employment possibilities in the development of minor forest produce, which is another important employment generating forestry activity. We have explained later in Chapter 58 on Rural Employment in some detail the assumptions made in projecting the future rural employment possibilities in the forestry sector. The present employment (1970) is estimated to be 2.3 million man-years. It is estimated that in the forestry sector as a whole, the additional rural employment generated will be of the order of 5.5 million man-years by 2000 A.D. In addition, there is a large scope for employment in rural areas in the transport of forest produce and in forest based industries, such as sawmilling, pulp and paper, panel products, matches, *katha*, resin, lac, etc.

15 SUMMARY OF RECOMMENDATIONS

42.15.1 Some important aspects of the production and social forestry have been dealt with by us in our Interim Reports on Production Forestry — Man-made Forests and Social Forestry. The recommendations made in the two Interim Reports may be referred to. Some

of the important recommendations made in this chapter are given below:

1. In order to meet the industrial wood requirement projected for 1980, 1985 and 2000 AD, an extent of about 48 million ha of forest lands should be identified immediately for being dedicated as production forests in use.

(Paragraph 42.2.17)

2. With regard to sawnwood and roundwood, studies should be taken up on consumption trend for the next 10 years, in order to revise the requirement on more realistic data.

(Paragraph 42.2.5)

3. A dynamic programme of social forestry should be taken up to supplement fuelwood and small timber production, in order to meet fully the requirement in the rural areas. The transportation of fuelwood to urban areas should be discouraged in the long run.

(Paragraph 42.2.23)

4. Forest lands should not be leased to the forest based industries for raising plantations to meet their own industrial wood requirement. The produce, however, should be allocated to different industries at an economic price.

(Paragraph 42.3.18)

5. Trade names for export purposes should be standardised. The Forest Research Institute, Dehra Dun should immediately take up preparation of publicity material, pointing out the characteristics and uses of each species and its equivalence with those already in demand in the export market.

(Paragraph 42.4.6)

6. Export of well known species that are in demand in the export market should be allowed liberally, and use of other available hardwood species popularised as substitutes in the domestic market. Export of roundwood, however, should be progressively discouraged and that of processed sawnwood and panel products encouraged.

(Paragraphs 42.4.9 and 42.4.10)

7. The prospect of diversion of sawnwood for export should be studied in depth. Imposition of a severe excise duty on teak sawnwood should be considered so as to restrict domestic consumption.

(Paragraph 42.4.9)

8. It should be necessary to locate the areas of abundant availability of timber for establishing saw mills and other industries for export purposes, by undertaking an inventory of resources. In such saw mills, precision machinery should be installed and kiln-drying facility introduced. There should be a strict adherence to grading.

(Paragraphs 42.4.10, 42.4.11 and 42.4.23)

9. This country should be associated with the various technical and other studies being carried out by the Economic and Social Commission for Asia and the Pacific (ESCAP) in regard to timber exporting countries of Asia and the Pacific.

(Paragraph 42.4.11)

10. The installed capacity in the saw-milling industry should be such that over and above meeting the domestic needs completely by 1985, there is enough surplus capacity for export.

(Paragraph 42.4.13)

11. Over and above meeting the entire domestic requirement by 1985, at least an equal quantity of plywood and veneer should be exported through aggressive export promotion and production of quality materials.

(Paragraph 42.4.14)

12. For greater export of panel products, the markets in the West Asian and North African countries should be cultivated.

(Paragraph 42.4.17)

13. Glue of international quality and at international prices should be made available to plywood factories specifically oriented towards export.

(Paragraph 42.4.17)

14. For increasing export of half-wrought and shaped wood products, market intelligence about the kind of wooden toys and articles in demand should be collected, Indian entrepreneurs encouraged to open shops in foreign countries and export promoted through the All-India Handicrafts Board.

(Paragraph 42.4.19)

15. An Export Promotion Council for Forest Products should be set up.

(Paragraph 42.4.21)

16. The forest development corporations should undertake promotion of exports and allocate necessary finance for it.

(Paragraph 42.4.22)

17. A suitable training programme should be devised for persons to be in charge of export oriented forest industries.

(Paragraph 42.4.23)

18. The range of species and quality of timber utilised in different forest based industries should continue to be extended in order that this country can enter the export market aggressively after meeting the domestic requirement or substitute import of products like newsprint. Research is required to be initiated, so that the number of simultaneously used wood species of mixed tropical forests is considerably widened for utilisation in the fibreboard and pulp industries.

(Paragraphs 42.5.3 and 42.5.6)

19. Since particle boards and fibreboards make a greater use of secondary raw materials and residues from logging, sawmilling and other industries, the poor record of production of these two categories of industries should be looked into.

(Paragraph 42.5.17)

20. The growing demand of the match industry should be met both by conserving the existing resource and by creating new plantations. In addition to raising plantation of traditional matchwood species, poplar should be raised where feasible in pure plantations in forest areas and encouraged for planting under the programme of farm forestry.

(Paragraphs 42.5.21 and 42.5.22)

21. All matchwood species should be reserved for the exclusive use of match industry. Expansion of large scale matchwood industry, particularly for making splints and veneers, may be confined in future to the Andaman & Nicobar Islands, in view of the shortage of matchwood in the mainlands.

(Paragraph 42.5.22)

22. A selective mechanisation in logging should be adopted, so that any impediments in opening up of inaccessible forest areas may be removed and a reduction in logging and transport cost effected. Generally the emphasis should be on mechanical innovations of lower technical sophistication, such as skyline cranes, ropeways, mountain tractors and improved logging tools.

(Paragraphs 42.6.12 and 42.6.14 to 42.6.17)

23. For loading and unloading, mechanisation should be adopted only where the quantity of timber to be handled annually is large.

(Paragraph 42.6.19)

24. As far as possible no sale of timber standing in the forests should be made. After departmental logging, either through direct employment of local labour or through labour cooperatives, all timber should be brought to a sale depot outside the forests and sale should be made at that point only.

(Paragraph 42.6.22)

25. It should be necessary to plan for construction of about 215,000 km of additional forest roads in the next 25 years for successful implementation of production forestry programme.

(Paragraph 42.7.3)

26. A review of the fertiliser requirements, current as well as prospective, should be undertaken, and the requirement of the forestry sector arranged without any conflict with the agriculturists' demands.

(Paragraph 42.7.4)

27. The seed testing rules and seed certification scheme framed by the Forest Research Institute, Dehra Dun should be adopted by the State Forest Departments. The State forest research organisations should carry out selection of *plus* trees of important species and establish seed orchards and clone multiplication plots where necessary.

(Paragraph 42.7.7)

28. In the case of imported seeds, a list of quarantine procedure and regulations affecting trees, seeds, seedlings and wood products should be compiled, with a view to encouraging standardisation of plant quarantine regulations among countries leading eventually to greater reliance being placed on pre-entry quarantine inspections in the country of origin. There should be regular post-entry quarantine inspections of all nurseries and plantations raised on imported seeds.

(Paragraphs 42.7.7 and 42.8.31)

29. The Forest Departments should identify the waste lands and marginal lands within the canal commands, and the estimates of the fund and water requirement, where a minimum of 100 ha at one place is available for raising irrigated plantations, should be made for inclusion in the report for the irrigation project.

(Paragraph 42.7.11)

30. The Council of Forest Research and Education should initiate research on the water consumption of different species in order to minimise the expense on irrigation as well as to avoid over-irrigation.

(Paragraph 42.7.11)

31. The forest planning cell in the Union Ministry of Agriculture & Irrigation should take up a study of the quantum of institutional credit required by the forest development corporations at least upto the year 1985.

(Paragraph 42.7.13)

32. Amendment of the tax laws should be considered so that reasonable deductions are allowed to the forest development corporations, from the net income from the sale of the existing crop, for creation and maintenance of man-made forests on the felled areas.

(Paragraph 42.7.13)

33. The programme of identification of forest diseases and insects should be enlarged, and check lists prepared giving their geographical distribution as well.

(Paragraph 42.8.20)

34. Secondary species and less valuable timber should be used for domestic requirements after seasoning and chemical treatment. The Government departments should give more importance to the use of such timber.

(Paragraph 42.8.21)

35. Before deciding upon any control measures, the impact of the disease or insect attack should be evaluated, if possible, by techniques of cost-benefit analysis, and the feasibility and the magnitude of control measures worked out. The control measures would broadly be: (a) biological and silvicultural, (b) chemical, (c) integrated management and (d) quarantine.

(Paragraphs 42.8.22 to 42.8.31)

36. Genetic control should also be resorted to by breeding strains, immune or less prone to non-injurious organisms. Chemical control should be used after careful consideration of the effect of chemicals on non-target organisms, which may include the predators or parasites of the target organisms and many others useful to man.

(Paragraphs 42.8.24 to 42.8.27)

37. While taking up man-made forests programme, the eventualities of increased danger from diseases and insect pests should be considered and protective measures provided for before undertaking the programme.

(Paragraph 42.8.32)

38. Exemption of the value of trees standing on agricultural land (not being trees in any orchard or plantation) from wealth tax should form a permanent provision in the Wealth Tax Act.

(Paragraph 42.9.5)

39. The condition, management and improvement of forest lands in the river valley catchments should as a matter of rule, be a concern of the watershed management programme. Particular attention should be paid to the degraded forest lands in the catchments, and they should be brought back to proper condition through reforestation wherever necessary.

(Paragraphs 42.10.5 and 42.10.7)

40. In order to get full benefit from forest management in catchment areas, measures suggested with respect to forest grazing, shifting cultivation and forest protection in Sections 11 and 12 of this chapter and in Chapter 43 should be rigorously pursued.

(Paragraph 42.10.9)

41. The degraded lands in the catchments outside the forest areas should be brought under social forestry, either for plantation of quick growing fuel species or for development of grasslands and grass reserves by linking it up with the programme of improvement of livestock.

(Paragraph 42.10.9)

42. The ravines starting from their upper end to their confluence with the main river should be treated as a whole. In general, the heads of the ravines should be treated for developing grasslands, while the middle to lower slopes and deep ravines should be tackled by

afforestation, supplemented by necessary engineering structures. Grazing should be prohibited in the treated areas and only cutting of grass allowed.

(Paragraph 42.10.11)

43. The technique already evolved by the Punjab Forest Department for afforestation for the control of *chos* and reclamation of *cho* lands should be extensively adopted.

(Paragraph 42.10.12)

44. The degree of regulating grazing in forests should be guided by their classification according to the functions they are primarily to fulfil under management. Attempts should be made to prohibit grazing in protected forests. In the production forests, grazing can be treated only as a fringe benefit. The provision of grazing and grass would be one of the primary objectives of social forestry.

(Paragraph 42.11.20)

45. Research should be taken up immediately for fixing the optimum carrying capacity of all types of forests, including those to be created under social forestry programme. A few upper catchments of river valley projects should be selected for investigations on the effect of grazing on soil and water conservation.

(Paragraphs 42.11.20 and 42.11.22)

46. People owning livestock in the vicinity of wildlife preserves should be persuaded to take to stall feeding, for which permission to cut grass and fodder in a controlled manner may be given.

(Paragraph 42.11.21)

47. Grazing rules should be promulgated by each State Government, specifying the grazing rates and providing for the manner in which grazing should be permitted, grazing units constituted, carrying capacity fixed, grazing and closure cycle indicated and administration of rules carried out.

(Paragraph 42.11.22)

48. Grazing rates should be upgraded substantially to curb non-essential cattle in forests, though grazing should not be looked upon as a source of revenue.

(Paragraph 42.11.23)

49. Grazing should be completely prohibited in the young regeneration areas. Grasses should be allowed to be cut from these areas and the hay utilised for feeding the essential livestock outside the forests.

(Paragraph 42.11.24)

50. Where a large programme of grassland development is taken up by the Forest Departments, they should employ adequate number of agrostologists/agronomists and range management specialists. In the State forest research organisations, these specialists should conduct research in collaboration with the agricultural universities and

experts from Agriculture, Animal Husbandry and Sheep Development Departments.

(Paragraph 42.11.27)

51. The improvement and maintenance of grasslands and open forests suitable for management as grass reserves should be part of a multidisciplinary approach to the livestock feeds and fodder problem, as elaborated in the text.

(Paragraph 42.11.28)

52. Plantation of fodder trees should be taken up as a part of social forestry, and the programme should be coupled with those for hay making and ensilage on a wide scale and livestock development. Provisions should be made in the working plans and project plans for allowing lopping of fodder leaves in the felling coupes just ahead of the felling.

(Paragraph 42.11.31)

53. The approach to the solution of the problem of shifting cultivation should be by permanently settling the shifting cultivators along with a simultaneous programme of afforestation through agri-silvicultural methods, pasture and grassland development, introduction of horticulture crops as well as plantation crops.

(Paragraphs 42.12.19 and 42.12.21)

54. Suitable areas in the lower reaches and valley lands and on gentle slopes should be terraced for fixed agriculture by the shifting cultivators. Before taking up the works, the possibility of continued financing of maintenance of terraces and institutional arrangements for irrigation, seed, fertiliser, etc. should be ensured.

(Paragraph 42.12.19)

55. Fair price shops should be opened for assured supply of essential commodities at reasonable rates to the tribals, including opening of *nistarbhandars* (depots) for supply of domestic requirement of the tribals in respect of forest produce.

(Paragraph 42.12.20)

56. The tribals should be allotted homestead lands, where programmes of afforestation, pasture and grassland development, introduction of horticulture crops, etc. are taken up.

(Paragraph 42.12.22)

57. The tribals should be trained for absorption in the forest based industries that may be set up as a part of commercial production forestry programme in the tribal areas, so that dependence on outside labour is reduced.

(Paragraph 42.12.24)

58. The Forest Departments should coordinate all activities concerning the problem of shifting cultivation. Adequate use of the organisational capacities of the Forest Departments should be made to

tackle the problem of tribal development generally. There should be a multidisciplinary approach and involvement right from the planning stage.

(Paragraph 42.12.25)

59. The economic development of the Andaman & Nicobar Islands should be based on the forest development programmes.

(Paragraph 42.13.2)

60. The existing working plan organisation should be strengthened for preparing a production oriented management plan for forests of South, Middle and North Andamans. A new working plan organisation should also be set up for taking up immediately the initial working plan works in other islands. A Planning and Project Formulation Cell should be established under the Chief Conservator of Forests immediately, so that the planning of chosen existing and new industries can also start simultaneously.

(Paragraphs 42.13.16 and 42.13.25)

61. A research centre should be established at Port Blair immediately and by 1980 converted into a fullfledged regional research institute, in order to strengthen the research base in the Islands and to provide information for preparing production oriented management plan.

(Paragraph 42.13.19)

62. A Forest Development Corporation in the Islands should be set up very early in line with the recommendations in our Interim Report on Production Forestry — Man-made Forests.

(Paragraph 42.13.20)

63. The Logging Training Centres Project in Dehra Dun should be associated with preparing logging plans suited to the topography and environmental conditions of the Islands. Importance should be attached for the completion of logging plans before the proposed corporation starts functioning.

(Paragraph 42.13.22)

64. For the integrated approach to planning for development of forest and forest based industries, locations should be carefully selected so that these become the focal points of growth in the economy of the Islands.

(Paragraph 42.13.24)

65. Arrangements should be made for direct shipping of forest products from the Islands for export to foreign countries, for which port and loading facilities should be developed in the focal points of growth.

(Paragraph 42.13.26)

66. Mechanisation of felling and transport and an efficient system of water transport should be evolved. Knowhow and expertise from

other countries should be arranged. A study team of the Government of India should visit Malaysia and Indonesia to get information about the methods and facilities of loading and stowage of forest products for export.

(Paragraphs 42.13.28 and 42.13.29)

67. While the type and quality of labour to be imported from the mainland should be regulated and tied to different development programmes, the Island Administration should introduce training schemes for generating skills in the prospective employees of the settler population.

(Paragraph 42.13.32)

68. A mainland posting of forestry personnel in the professional grade may be alternated with a posting on the Islands. If this does not work satisfactorily, the possibility of the distribution of the Island cadre to some of the mainland States for the purpose of an exchange of posting may be considered.

(Paragraph 42.13.34)

69. For running the public sector industries and logging operations, the employment of retired defence services officers should be considered.

(Paragraph 42.13.35)

70. Building and other amenities should be constructed in a planned way in the selected growth centres and the headquarters of the Forest and other Departments should be suitably dispersed in the centres.

(Paragraph 42.13.37)

71. In the cold desert areas of Ladakh in Jammu & Kashmir and Lahaul-Spiti and Hangrang Valley in Himachal Pradesh, future forest development activities should be taken up with the active involvement of the local population, mainly to meet their requirements of fuel, fodder and small timber.

(Paragraph 42.13.46)

72. Provision of improved fodder for the local livestock through range management and grassland development should have the utmost priority. It will be necessary to regulate the entry of migratory graziers strictly in accordance with the carrying capacity of the grazing runs.

(Paragraph 42.13.47)

73. For a large scale afforestation and pasture development programme, a separate canal system with field channels should be constructed. Adequate administrative organisation should be built up, as suggested in the text.

(Paragraph 42.13.48)

74. Indiscriminate introduction of species should not be made, unless supported by an intensive research effort. Experimentation on conservation and best utilisation of available water should be taken up by the concerned agricultural development department and its findings should be available to the forestry personnel for optimum utilisation of water resource.

(Paragraph 42.13.49)

75. The Government of India should set up a centre for forest research on cold desert at Leh (Ladakh) with an experimental station under it in the Lahaul-Spiti area. Among other things, research should be taken up on improvement of alpine pastures, introduction of legumes, identification of deep rooted quick growing hardy species suitable for fuel and fodder, etc.

(Paragraphs 42.13.49 and 42.13.50)

76. The Central Board of Forestry should regularly meet every two years and its Standing Committee more frequently. The institution of the Standing Committee should be more effectively used.

(Paragraph 42.14.5)

77. The Central Forestry Commission must meet once in three months and perform the functions indicated in the text. Its strength should be augmented, so that it can function effectively as a permanent coordinating body at the professional and technical level, in addition to providing the necessary support to the Central Board of Forestry and its Standing Committee.

(Paragraph 42.14.5)

78. There should be a fullfledged Department of Forests in the Ministry of Agriculture & Irrigation with the Inspector General of Forests as the Secretary in-charge of the Department. The Department should have three Divisions, namely (a) Division of Forest Inventory, Planning and Evaluation, (b) Division of Wildlife, and (c) Division of Forest Research and Education. Each Division should be under the charge of an Additional Inspector General of Forests with the rank of Additional Secretary to the Government of India.

(Paragraphs 42.14.6 and 42.14.7)

79. The Chief Conservator of Forests should function as Secretary to the Government, and where there are more than one Chief Conservator of Forests in a State, the principal Chief Conservator of Forests should be accorded that status.

(Paragraph 42.14.10)

80. Each State should set up a committee under the Chief Conservator of Forests to fix up norms for delimiting circles, divisions, sub-divisions, ranges, etc. both for territorial and non-territorial

charges. Special functions of planning, utilisation, wildlife management, research and education, etc. should be taken into account.

(Paragraph 42.14.15)

81. The augmentation of the education and training facilities for different categories of forestry personnel should be planned somewhat ahead of the period in which the personnel are required to be in position, and should be based on the requirement projected in the text.

(Paragraphs 42.14 18 and 42.14.19)

APPENDIX 42.1

(Paragraph 42.2.5)

Projections of Pulp and Paper Requirements in India,
1980 to 2000 AD

In order to estimate the likely levels of domestic demand for pulp and paper requirements we have assumed that the growth in their consumption has a direct relationship with the growth in Gross Domestic Product (GDP). A simple relationship has thus been established between the per capita consumption of different types of pulp and paper, i.e. printing and writing paper, news print, packing and wrapping paper (industrial paper), paperboards and dissolving pulp, and per capita GDP at constant prices. This relationship has then been used to estimate the likely levels of expected demand for pulp and paper products in the years to come, on the basis of the projected rates of growth in per capita GDP and population given in Chapter 10 on Demand Projections.

For the purpose of this analysis we have fitted alternative regression functions to the estimates of per capita GDP and per capita consumption of various categories of paper and pulp during 1950 to 1970 (*vide* Statement I). We have assumed that the recent trends would not undergo any significant change at least during the next decade and as such we have used the best fitting regression functions to work out the future per capita demand for various categories of pulp and paper products. In a longer term perspective extending to the turn of the century, however, it is possible to rectify the past imbalances in the consumption of various categories of pulp and paper by proper planning of forestry and forest industrial sector. For this purpose we have analysed the demand for different uses of pulp and paper under two assumptions, viz. (a) with marginal imports, i.e. printing and writing paper and paperboard; and (b) with significant imports, i.e. newsprint, dissolving pulp and industrial paper. In the case of first assumption the important considerations are whether the present trends in the consumption of different categories should be allowed to continue or a lower level of consumption should be planned. In the case of second assumption the major considerations would be either to allow the present trends in consumption to continue over the long term period, or to plan for a more steeply rising consumption, keeping in view the fact that the existing consumption is restricted because of import constraints. We have carefully analysed these considerations and have used appropriate forms of regression functions (Statement II) for working out the estimates of per capita demand for pulp and paper.

The following table gives the per capita GDP, corresponding to the estimates of private final consumption estimates given in Chapter 10, and the projected estimates of population in 1980, 1985 and 2000 AD.

TABLE I

Projections of per Capita GDP and Population—1980, 1985 and 2000 AD

Year	Per capita GDP (1971—72 prices)		Population (millions)
	low (Rs.)	high (Rs.)	
1970	714	714	540
1980	841	916	660
1985	932	1,127	725
2000 AD	1,331	1,772	935

On the basis of the aforesaid assumptions, the low and the high estimates of the levels of per capita demand for different categories of pulp and paper for 1980, 1985 and 2000 AD are given in Table II below:

TABLE II

Per Capita Consumption of Various Categories of Pulp and Paper—1980, 1985 and 2000 AD

Category of paper	1970	(Kg per annum)					
		1980		1985		2000 AD	
		low	high	low	high	low	high
printing & writing paper	0.75	1.11	1.26	1.29	1.62	1.90	3.93
newsprint	0.32	0.43	0.49	0.50	0.65	0.81	1.36
industrial paper	0.29	0.37	0.43	0.44	0.59	0.75	1.44
paperboard	0.31	0.50	0.56	0.57	0.71	0.83	1.65
dissolving pulp	0.26	0.46	0.52	0.54	0.69	1.09	1.64

At these levels of per capita demand, estimated aggregate demand will be of the following order:

TABLE III

Aggregate Domestic Consumption of Various Categories of Pulp & Paper—1980, 1985 and 2000 AD

Items	1970						
		1980		1985		2000 AD	
		low	high	low	high	low	high
printing & writing paper	405	733	832	935	1,175	1,777	3,675
newsprint	175	284	323	363	471	757	1,272
industrial paper	158	244	284	319	428	701	1,346
paperboard	166	330	370	413	515	176	1,543
dissolving pulp	139	304	343	392	500	1,019	1,533

Statement I: Basic Time Series Data on Consumption of Various Categories of Paper and pulp in India, 1950-1970

Year	GDP per capita in Rs. (1960-61 prices)	Consumption (kg/capita)				
		Printing & writing paper	Newsprint	Industrial paper	Paperboard	Dissolving pulp
1950 . . .	266	0.223	0.211	0.084	0.126	NA
1951 . . .	268	0.254	0.141	0.181	0.145	NA
1952 . . .	272	0.300	0.143	0.106	0.119	NA
1953 . . .	283	0.306	0.191	0.110	0.139	NA
1954 . . .	286	0.314	0.207	0.115	0.133	NA
1955 . . .	291	0.358	0.211	0.141	0.190	NA
1956 . . .	301	0.342	0.148	0.135	0.189	NA
1957 . . .	291	0.351	0.197	0.162	0.207	NA
1958 . . .	308	0.410	0.191	0.155	0.228	0.127
1959 . . .	309	0.431	0.231	0.169	0.228	0.165
1960 . . .	324	0.513	0.230	0.205	0.274	0.168
1961 . . .	317	0.532	0.273	0.192	0.268	0.124
1962 . . .	330	0.530	0.270	0.214	0.304	0.145
1963 . . .	340	0.668	0.275	0.214	0.313	0.322
1964 . . .	359	0.684	0.277	0.226	0.318	0.281
1965 . . .	325	0.720	0.237	0.219	0.365	0.298
1966 . . .	333	0.786	0.313	0.216	0.328	0.242
1967 . . .	355	0.763	0.306	0.214	0.326	0.285
1970 . . .	380	0.749	0.323	0.292	0.307	0.256

NA=Not Available.

Statement II: Form of Regression Function Adopted

	1980 and 1985		2000 AD	
			Low estimate	High estimate
printing and writing paper	$Y=a+b \log x$	$Y=a+b \log x$	$Y=a+b x$	$Y=a+b x$
newsprint	$Y=a+b x$	$Y=a+b x$	$\log Y=a+b \log x$	$\log Y=a+b \log x$
industrial paper	$Y=a+b x$	$Y=a+b x$	$\log Y=a+b \log x$	$\log Y=a+b \log x$
paperboard	$Y=a+b \log x$	$Y=a+b \log x$	$Y=a+b x$	$Y=a+b x$
dissolving pulp	$Y=a+b \log x$	$Y=a+b x$	$\log Y=a+b \log x$	$\log Y=a+b \log x$

here

Y = per capita consumption of pulp and paper products, and

x = per capita Gross Domestic product.

APPENDIX 42.2

(Paragraph 42.2.1)

Aggregate Raw Material Requirement for 1980, 1985 and 2000 AD under Assumptions of High Income Growth
(in '000 m³ (r))

Item	Coniferous wood			Hardwood			Total wood		
	1980	1985	2000	1980	1985	2000	1980	1985	2000
sawnwood	2,020	2,600	4,020	12,080	15,700	25,630	14,100	18,300	29,650
panel products—									
plywood & veneer	120	190	430	480	775	1,725	600	965	2,155
fibreboard	20	25	40	75	100	160	95	125	200
pulp and paper	1,100	1,615	5,975	3,075	4,440	11,720	4,175	6,055	17,695
matchwood* . . . . .	..	..	..	535	680	1,415	535	680	1,415
roundwood	1,480	1,810	2,665	5,910	7,245	10,670	7,390	9,055	13,335
total	4,740	6,240	13,130	22,155	28,940	51,320	26,895	35,180	64,450

* See paragraph 42.5.18. The demands for 1980 and 1985 have been interpolated

APPENDIX 42.3

(Paragraph 42.2.7)

Aggregate Raw Material Requirement for 1980, 1985 and 2000 AD under Assumptions of Low income Growth

(in '000 m³(r))

Item	Coniferous wood			Hardwood			Total wood		
	1980	1985	2000	1980	1985	2000	1980	1985	2000
sawnwood	.	.	.	1,890	2,235	3,230	11,255	13,430	19,710
panel products—									
plywood & veneer	.	.	.	105	140	270	415	560	1,075
fibreboard	.	.	.	15	20	30	70	85	125
pulp and paper	.	.	.	965	1,240	3,195	2,710	3,475	6,485
matchwood*	535	680	1,415
roundwood	.	.	.	1,410	1,630	2,330	5,635	6,535	9,315
total	.	.	.	4,385	5,265	9,055	20,620	24,765	38,125
							25,005	30,030	47,180

* No separate projections for 'high' and 'low' demand have been made. The same figures as in the case of 'high' demand (Appendix 42.2) have been adopted.

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APPENDIX 42.4

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(Paragraph 42.2.19)

Classification of States According to Total Wood Removal from Forests under the control of the Forest Departments

Class interval	State/Union Territory	Average removal of wood (industrial wood plus fuelwood) for the period 1965-66 to 1969-70 ¹	Per capita forest area (1969-70) ²
		m ³ (r)/ha/yr	ha
0—0.20	Andhra Pradesh	0.17	0.15
	Andaman & Nicobar Islands	0.15	6.50
	Arunachal Pradesh	0.03	11.58
	Manipur	0.06	0.56
	Orissa	0.17	0.31
	Rajasthan	0.04	0.15
0.21—0.40	Assam*	0.30	0.28
	Bihar	0.21	0.05
	Gujarat	0.25	0.07
	Himachal Pradesh	0.33	0.63
	Jammu & Kashmir	0.21	0.46
	Madhya Pradesh	0.29	0.41
	Tamil Nadu	0.29	0.05
0.41—0.60	Tripura	0.23	0.40
	Haryana	0.52	0.01
	Maharashtra	0.43	0.13
	Nagaland	0.52	0.56
0.61 and above	Goa, Daman & Diu	0.70	0.12
	Karnataka	0.61	0.12
	Kerala	1.11	0.06
	Punjab	0.69	0.01
	Uttar Pradesh	0.94	0.06
	West Bengal	0.86	0.03

* Includes Meghalaya and Mizoram.

¹Adjusted from figures in Table 1.2 of Forest Statistics, Bulletin No. 13, Central Forestry Commission, February, 1972.

²Appendix II, Forest Statistics, Bulletin No. 14, Central Forestry Commission, August, 1972.

APPENDIX 42.5

(Paragraph 42.4.2)

Value of Exports of Major Forest Produce from India¹

Value of Exports of Major Manufactures									
Item	(Rs. in lakhs)								
	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	Total 1972-73 to 1974-75	Average Percentage 1972-73 to 1974-75	of col.9 to its total
1	2	3	4	5	6	7	8	9	10
I. wood, lumber and cork	6,89.68	5,96.98	6,96.40	9,50.97	17,20.36	9,39.51	36,10.84	12,03.61	51.84
(i) fuelwood and charcoal	1.58	0.73	0.69	0.25	0.70	3.56	4.51	1.50	0.07
(ii) wood in the round or roughly squared	6,83.25	5,94.23	6,91.40	9,42.73	17,00.25	8,91.46	35,34.44	11,78.15	50.74
of which :									
red sanders	10.45	15.43	18.83	16.56	34.91	28.27	79.74	26.58	1.14
rosewood	5,63.88	4,59.23	5,70.26	8,17.27	14,88.74	5,46.22	28,52.23	9,50.75	40.95
salwood	..	..	8.02	21.32	37.81	15.24	74.37	24.79	1.07
sandalwood	60.83	55.06	57.02	51.41	70.17	77.24	1,98.82	66.27	2.85
teakwood	13.89	11.70	7.39	4.19	14.46	1,30.82	1,49.47	49.83	2.15
others	34.20	52.81	29.88	31.98	54.16	93.67	1,79.81	59.93	2.58
(iii) wood shaped or simply worked	4.10	1.79	3.88	7.77	19.41	44.49	71.67	23.89	1.03
(iv) cork raw and waste	0.75	0.23	0.43	0.22	..	..	0.22	0.07	neg
II. pulp and waste paper	51.95	1,01.46	21.27	1.52	1.76	1.18	4.46	1.49	0.07
III. wood and cork manufactures excluding furniture)	93.90	1,65.36	1,19.25	1,26.71	4,97.19	8,28.54	14,52.44	4,84.14	20.85

(i) veneers, plywood boards & other wood worked NES of which :	76.13	1,41.68	1,03.57	1,09.83	4,56.74	7,37.53	13,04.10	4,34.70	18.72
plywood sheets	6.24	7.10	2.04	9.52	16.84	38.41	64.77	21.59	0.932
plywood including wood faced with veneer sheets	67.34	1,30.80	99.06	84.34	3,91.61	6,55.02	11,30.97	3,76.99	16.24
others	2.55	3.78	2.47	15.97	48.29	44.10	1,08.36	36.12	1.55
(ii) wood manufactures not elsewhere specified	17.23	21.18	15.18	15.16	38.32	89.51	1,42.99	47.66	2.05
(iii) cork manufactures	0.54	2.50	0.50	1.72	2.13	1.50	5.35	1.78	0.08
IV. paper and paper board and manufactures thereof	4,87.99	5,40.83	2,94.12	4,16.16	6,90.35	7,11.89	18,18.40	6,06.14	26.10
(i) paper and paperboard	3,84.11	3,93.67	1,42.57	2,13.69	4,31.29	3,88.12	10,33.10	3,44.37	14.83
of which :									
newsprint . . . .	..	..	..	..	1.65	..	1.65	0.55	0.03
printing and writing paper	2,60.50	2,47.72	76.24	56.50	1,85.62	81.36	3,23.48	1,07.83	4.64
others	1,23.61	1,45.89	66.33	1,57.19	2,44.02	3,06.76	7,07.97	2,35.99	10.16
(ii) articles made of pulp, paper and paperboard	1,03.88	1,47.16	1,51.55	2,02.47	2,59.06	3,23.77	7,85.30	2,61.77	11.27
V. wood furniture and fixtures excluding artware	5.64	8.77	5.70	14.15	21.20	43.85	79.20	26.40	1.14
total	13,29.16	14,13.40	11,36.74	15,09.51	29,30.86	25,24.97	69,65.34	23,21.78	100.00

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta. Directorate General of Commercial Intelligence and Statistics, Government of India.

APPENDIX 42.6

(Paragraph 42.4.6)

Statement I—Regionwise Export of Red Sanders¹value—Rs. lakhs
quantity—m³

Economic region	1969-70		1970-71		1971-72		1972-73		1973-74		1974-75	
	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value
0 Africa	..	..	..	..	..	..	..	..	..	..	..	..
1 North America	..	..	..	..	..	..	..	..	..	..	1	0.06
2 Latin America	..	..	..	..	..	..	..	..	..	..	..	..
3 Other American countries	..	..	..	..	..	..	2	0.08	..	..	7	0.27
4 ESCAP countries (including China)	307	10.31	475	15.27	432	18.53	200	16.24	766	34.87	271	27.66
5 Other Asian and Oceanian countries and Antarctic and Arctic regions	..	..	..	..	..	..	..	..	..	..	..	..
6 East European countries	..	..	..	..	2	0.05	..	..	..	..	..	..
7 European Common Market countries	2	0.04	..	..	..	0.05	3	0.09	2	0.04	8	0.28
8 European Free Trade Area countries	2	0.10	..	..	..	..	7	0.15	..	..	..	..
9 Other European countries	..	..	..	..	..	..	..	..	..	..	..	..
total	311	10.45	480	15.43	441	18.83	212	16.56	768	34.91	287	28.27

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta. Directorate General of Commercial Intelligence and Statistics, Government of India.

APPENDIX 42.6 (Contd.)

Statement II—Regionwise Export of Rosewood¹

value—Rs. lakhs
quantity—m³

Economic region	1969-70		1970-71		1971-72		1972-73		1973-74		1974-75	
	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value
0 Africa	1	0.05	..	..	..	..	..	..	..	..	..	..
1 North America	455	17.26	484	20.43	208	6.59	371	19.35	417	32.32	397	31.84
2 Latin America	..	..	..	..	..	..	..	..	..	..	4	0.16
3 Other American countries	..	..	..	..	..	..	..	..	..	..	..	..
4 ESCAP countries (including China)	12,838	3,08.82	8,704	2,19.39	12,085	2,98.10	16,585	4,72.66	18,246	10,33.42	6,579	2,57.30
5 Other Asian and oceanian countries and Antarctic and Arctic regions	8	0.13	6	0.11	24	0.49	..	..	52	1.78	81	2.01
6 East European countries	136	4.42	25	1.12	16	0.66	64	3.95	7	0.20	..	..
7 East European Common Market countries	8,636	2,26.82	6,926	2,11.08	7,576	2,54.57	9,827	3,16.89	11,199	4,14.96	5,404	2,46.02
8 European Free Trade Area countries	219	5.22	119	3.32	351	8.32	..	..	..	..	58	1.49
9 Other European countries	46	1.16	149	3.78	39	1.53	152	4.42	260	6.06	169	7.40
total	22,339	5,63.88	16,413	4,59.23	20,299	5,70.26	26,999	8,17.27	30,181	14,88.74	12,692	5,46.22

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta. Directorate General of Commercial Intelligence and Statistics, Government of India.

APPENDIX 42.6 (Contd.)
Statement III—Regionwise Export of Salwood¹

Economic region	1969-70		1970-71		1971-72		1972-73		1973-74		1974-75	
	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value
0 Africa
1 North America
2 Latin America
3 Other American countries
4 ESCAP countries (including China)	321	8.02	2,418	21.32	5,076	37.75	1,514	10.91	..
5 Other Asian and oceanian countries and Antarctic and Arctic regions
6 East European countries	5	0.06	161	4.33	..
7 European Common Market countries
8 European Free Trade Area countries
9 Other European countries
total	321	8.02	2,418	21.32	..	5,081	37.81	1,675	15.24

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta. Directorate General of Commercial Intelligence and Statistics, Government of India.

APPENDIX 42.6 (Contd.)
Statement IV—Regionwise Export of Sandalwood¹

Economic region	1969-70		1970-71		1971-72		1972-73		1973-74		1974-75	
	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value
0 Africa	150	17.62	172	19.55	215	23.41	121	14.04	81	10.24	80	21.60
1 North America	..	neg	1	0.05	10	1.25	..	neg	2	0.18	28	4.09
2 Latin America	..	..	..	..	..	..	..	..	..	..	..	..
3 Other American countries	..	..	..	..	..	neg	..	..	..	..	..	..
4 ESCAP countries (including China)	286	42.72	226	32.97	217	31.08	245	35.47	282	56.48	110	45.00
5 Other Asian and Oceanian countries and Antarctic and Arctic regions	1	0.24	3	0.48	2	0.56	3	0.59	14	0.79	4	1.08
6 East European countries	..	..	..	..	..	..	4	0.48	..	..	..	0.15
7 European Common Market countries	3	0.25	15	0.01	7	0.72	8	0.78	15	1.83	12	0.08
8 European Free Trade Area countries	..	..	..	..	..	..	..	..	3	0.52	10	3.15
9 Other European countries	..	..	..	..	..	..	..	0.05	2	0.13	..	..
total	440	60.83	417	55.06	451	57.02	381	51.41	399	70.17	244	77.24

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta, Directorate General of Commercial Intelligence and Statistics, Government of India.

APPENDIX 42.6. (Contd.)
Statement V—Regionwise Export of Teakwood¹

Economic region	1969-70		1970-71		1971-72		1972-73		1973-74		1974-75	
	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value	quan- tity	value
0 Africa	..	..	..	..	40	1.49	..	..	..	..	31	0.42
1 North America	17	0.46	..	..	..	..	..	..	35	0.75	34	1.05
2 Latin America	..	..	..	..	..	..	..	..	..	..	1	0.02
3 Other American countries	..	..	..	..	..	..	..	..	..	..	..	..
4 ESCAP countries (including China)	207	3.90	118	1.98	27	0.54	21	0.42	297	5.32	518	12.65
5 Other Asian and Oceanian countries and Antarctic and Arctic regions	337	3.49	748	9.59	406	5.23	166	3.41	446	6.85	37.04	10.74
6 East European countries	48	1.57	..	..	..	..	..	..	..	..	..	..
7 European Common Market countries	275	4.30	16	0.13	7	0.13	17	0.36	80	1.54	164	4.74
8 European Free Trade Area countries	13	0.17	..	..	..	..	..	..	..	..	52	1.19
9 Other European countries	..	..	..	..	..	..	..	..	..	..	..	..
total	897	13.89	882	11.70	480	7.39	204	4.19	858	14.46	4,504	1,30.81

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta. Directorate General of Commercial Intelligence and Statistics, Government of India.

APPENDIX 42.7

(Paragraph 42.4.6)

Most Common Indian Hardwood Timber Species with their Weight, Natural Durability and Zones of Availability, grouped according to their Important Uses

Sl.No.	Name of the species	Trade name in Indian timber market	Weight at 12 per cent moisture content in kg/m ³	Natural durability	Zone where available
1	2	3	4	5	6
A. Timber species used for construction purposes—					
1	<i>Acacia catechu</i> Willd.	.	.	.	east, central, north
2	<i>Albizia lebbek</i> (Linn.) Benth	.	.	.	east
3	<i>Bridelia retusa</i> Spreng.	.	.	.	east
4	<i>Careya arborea</i> Roxb.	.	.	.	east
5	<i>Cassia fistula</i> Linn.	.	.	.	east
6	<i>Delbergia latifolia</i> Roxb.	.	.	.	south
7	<i>Dalbergia sissoo</i> Roxb.	.	.	.	north
8	<i>Dipterocarpus</i> spp	.	.	.	south
9	<i>Lagerstroemia lanceolata</i> Wall.	.	.	.	south
10	<i>Maduca longifolia</i> (Koenig) Mac Bride	.	.	.	east, central
11	<i>Mesua ferrea</i> Linn.	.	.	.	east
12	<i>Palaninum ellipticum</i> (Dalz.) Baillon	.	.	.	south
13	<i>Pterocarpus dalbergioides</i> Roxb.	.	.	.	east
14	<i>Pterocarpus marsupium</i> Roxb.	.	.	.	east, central
15	<i>Shorea robusta</i> Gaertn. f.	.	.	.	central, north

APPENDIX 42.7 (Contd.)

1	2	3	4	5	6
16	<i>Tectona grandis</i> Linn. f.	.	625	high	central, west, south
17	<i>Terminalia arjuna</i> W.&A.	.	815	moderate	east, central
18	<i>Terminalia alata</i> Heyne ex Roth syn. <i>T. tomentosa</i> W.&A.	laurel	880	moderate	east, central west, north
19	<i>Terminalia paniculata</i> Roth	kindal	800	moderate	south
20	<i>Xylia xylocarpa</i> (Roxb.) Taub.	irul	830	high	south
B. Timber species used for furniture and cabinet making—					
1	<i>Albizia lebeck</i>	koko	640	high	east
2	<i>Artocarpus chaplasha</i> Roxb.	chaplash	515	moderate	east
3	<i>Bridelia retusa</i>	kasi	595	moderate	east
4	<i>Dalbergia latifolia</i>	rosewood	770	high	south
5	<i>Dalbergia sissoo</i>	sissoo	785	moderate	north
6	<i>Dipterocarpus</i> spp	gurjan	785	moderate	south
7	<i>Pterocarpus dalbergioides</i>	padauk	720	high	east
8	<i>Pterocarpus marsupium</i>	bijasal	800	high	east, central
9	<i>Tectona grandis</i>	teak	625	high	west, central, south
10	<i>Terminalia paniculata</i>	kindal	800	moderate	south
11	<i>Terminalia tomentosa</i>	laurel	880	moderate	east, west, north, central

APPENDIX 42.8

(Paragraph 42.5.5)

Pulp Mix Required for Production of Paper and Pulp and Newsprint

(tonnes of pulp per tonne of product)

	conifer			hardwood							Others
	chemical	semi-chemical	mechanical	chemical	semi-chemical	mechanical	Bamboos	Waste paper	Bagasse		
1	2	3	4	5	6	7	8	9	10	11	
printing and writing paper											
1970	0.045	..	..	0.143	..	..	0.478	0.179	0.066	0.139	0.139
1980	0.076	..	..	0.093	0.360	..	0.453	..	..	0.068	0.068
2000 AD	0.150	..	..	0.120	0.345	..	0.125	0.122	0.033	0.065	0.065
newsprint											
1970t	..	..	..	..	..	0.600	0.450	..	..	..	..
1980	0.090	..	0.230	..	..	0.430	0.189	..	..	0.120	0.120
2000 AD	0.150	..	0.300	..	..	0.500	0.100	..	..	..	..
industrial paper											
1970	0.068	..	..	..	..	..	0.573	0.252	0.091	0.066	0.066
1980	0.283	..	..	..	0.233	..	0.451	..	0.050	0.033	0.033
2000 AD	0.350	..	..	0.100	0.162	..	0.174	0.150	0.081	0.033	0.033
absorbing paper											
1970	1.050	1.050
1980	0.150	0.900	0.900
2000 AD	0.200	0.200	..	0.650	0.650

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1	2	3	4	5	6	7	8	9	10	11
other paper & paperboard										
1970	0.572	0.284	0.117	0.077
1980	0.040	0.093	0.300	..	0.147	0.370	0.043	0.057
2000 AD	..	..	..	0.100	0.221	..	0.204	0.370	0.098	0.057
rayon grade pulp										
1970	..	..	..	0.210	..	..	0.840	..	..	..
1980	..	..	..	0.840	..	..	0.210	..	..	..
2000 AD	0.060	..	..	0.840	..	..	0.150	..	..	..

APPENDIX 42.9

(Paragraph 42.7.1)

Density of Forest Roads in Some States and Union Territories in India¹

State/Union Territory	Forest area reported by the Forest Departments to be under their control	Forest roads under the control of the Forest Departments	Density of forest roads
	('000 ha)	(km)	(km per sq km)
Assam	1,327	2,475	0.19
Bihar	2,928	13,171	0.45
Gujarat	1,567	1,416	0.09
Haryana	100	152	0.15
Himachal Pradesh	1,995	886	0.04
Jammu & Kashmir	2,104	658	0.03
Kerala	1,000	1,062	0.12
Madhya Pradesh	16,813	27,398	0.16
Maharashtra	5,612	10,789	0.19
Meghalaya	72	163	0.23
Orissa	6,618	6,569	0.09
Tamil Nadu	2,093	2,597	0.12
Tripura	629	332	0.05
Uttar Pradesh	4,098	14,910	0.36
West Bengal	1,157	2,940	0.25
Arunachal Pradesh	6,060	830	0.01
Total	54,173	86,348	0.16

¹ Compiled from information obtained from the Chief Conservators of Forests.

APPENDIX 42.10

(Paragraph 42.11.10)

Animals which Grazed in Forests

(number thousands)

Animals	Past position ¹			Current position		
	Total popula- tion as per 1956 Census	Animals gra- zed in forests 1957-58	Percentage of col. 3 to col. 2	Total popula- tion as per 1972 ² census (provisional)	Animals gra- zed in forests 1973-74 ³	Percentage of col. 6 to col. 5
cattle	158,651	17,133	10.8	178,865	26,115	14.8
buffaloes	44,916	4,303	9.6	57,941	9,892	17.1
sheep	39,246	12,579	13.3	40,395	11,208	27.8
goats	55,405			68,024	4,740	7.9
camels	776	146	18.9	1,126	121	10.8
other animals	2,642*	673	25.4	8,631	2,291	26.7

¹ 1961. One Hundred Years of Indian Forestry, Vol. II : p 57 (Table 16). Dehra Dun, FRI.² Eleventh All India Live-stock Census, 1972 (Provisional Figures), New Delhi. Directorate of Economics & Statistics, Ministry of Agriculture & Irrigation, Government of India.³ Chief Conservators of Forests. The figures exclude those for Karnataka, Kerala, Manipur, Meghalaya, Nagaland and West Bengal from where figures were not available.

* excludes pigs.

Note : separate data for sheep and goats for 1957-58 not available.

APPENDIX 42.11

Livestock Population¹ and Grazing Incidence in Forests in Some States²

(Paragraph 42.11.11)
(Number—thousands)
(Area—thousand hectares)

State	Total number of livestock	Number of grazing in forests	Percentage in forests	Equivalent in cow units	Total forest area closed to grazing (67-68)	Net area for open for cow units	Number of grazing per 100ha of open area
Andhra Pradesh	33,064	2,980	9.0	2,328	6,405	1,130	5,275
Assam	8,210	105	1.3	129	4,573	184	4,389
Bihar	27,946	8,530	30.5	9,945	3,059	475	2,584
Himachal Pradesh	4,703	4,005	85.1	3,312	2,158	240	1,918
Jammu & Kashmir	4,285	582	13.6	353	2,108	228	1,880
Madhya Pradesh	39,989	6,326	15.8	10,131	17,169	1,617	15,552
Maharashtra	26,361	5,251	19.9	5,310	6,672	719	5,953
Punjab	9,295	299	3.2	384	197	119	78
Rajasthan	38,878	3,002	7.7	2,947	3,758	577	3,181
Tamil Nadu	23,979	1,388	5.8	991	2,214	297	1,917
Tripura	738	811	..	793	630	33	597
Uttar Pradesh	49,099	2,005	4.1	1,837	4,282	721	4,161
Total	270,547	35,284	13.0	38,460	53,825	6,340	47,485
							81

¹ Eleventh All-India Livestock Census, 1972 (Provisional Figures), (New Delhi: Directorate of Economics & Statistics, Ministry of Agriculture & Irrigation, Government of India).

² Information from Chief Conservators of Forests.

APPENDIX 42.12

(Paragraph 42.11.26)

Grassland Improvement in Gujarat State

General

1.1 Grasslands in charge of the Forest Department are mainly located in Saurashtra and Kutch regions of Gujarat. These grasslands are scattered in small patches and surrounded by cultivation and habitation. Each patch of grassland is locally known as *vidi* in Saurashtra and *rakhal* in Kutch. There are in all 645 such *vidis* with a total area of about 160,000 ha. Prior to 1959 these *vidis* were in charge of the Revenue Department and were being managed by that Department. In 1959 all these *vidis* were transferred to the Forest Department.

1.2 Saurashtra and Kutch have a large cattle population, but some of the best breeds in the country, viz. *kankrej* and *banni*. The cattle breeders require, even in normal years, large quantities of hay for their use. Small *vidis* from which grass collection for storage is difficult or uneconomic are therefore either leased out for grass cutting and grazing to the local people. These *vidis* are termed as 'non-reserved *vidis*'.

1.3 Half the area in Gujarat is chronically drought affected and almost once in every three years suffers from severe scarcity conditions. Hay is therefore required to be supplied to sustain the valuable livestock in the scarcity areas during such years. The Forest Department collects grass from larger *vidis* and stores the hay after baling for the supply to scarcity affected areas. For this purpose, there are specially constructed grass godowns or hay stacks locally known as *ganjis*. Such *vidis* from which grass is collected and stored are termed as 'reserved *vidis*'.

1.4 There are no facilities of irrigation available in the *vidi* areas and production of grass is entirely dependent on the monsoon precipitation. Grass starts drying from the month of October onwards and is harvested in the period between November and February, when it is still somewhat green and is then allowed to dry in the *vidis*. Baling is done in the months of February and March mostly by hand presses and transport completed by March end. Bales are tied with 5 galvanised wire strands. Contracts for cutting, baling and transport to the godowns or places of stacking are auctioned in July every year and the rates are obtained per 500 Kg of grass delivered at the storing place. These rates vary from Rs. 30 to Rs. 60 per 500 Kg, depending on the topography of the area and the distance of storing places. Hay which is stored in fodder banks is preserved for three years and that stored in *ganjis* is kept for one year. If it is not required for the supply, it is disposed of by auction at the end of this period. After all the grass is harvested and removed, the *vidis* are thrown open to grazing on a biannual rotational grazing basis. Half the *vidi* is opened to grazing and the other half closed. However, in effect the entire *vidi* is grazed as there are no physical barriers to stop the cattle from entering in the area supposed to be closed to grazing.

Description of the Area

2.1 Soil of the *vidi* area is generally shallow with underlying rock in various stages of disintegration and is not fit to support good quality tree growth. However, shrubs like *Ziziphus*, *Euphorbia*, *Acacia*, *Carissa*, etc. grow profusely if not trampled, hacked or eradicated. Rainfall is scanty and erratic with long dry spells during the monsoon. The entire region except Junagadh district is classified as chronically drought affected area. The climatic climax of the region would be scrub land. However, due to heavy trampling and hacking of scrub growth, grass comes up in the area as subclimax vegetation. Due to heavy continuous trampling by the cattle, the soil had hardened and compacted to such an extent that it has become impervious to water and refractory to seed germination. Heavy utilisation of grasses for long periods has deteriorated the vigour of the root stock of perennial grasses and the regeneration from seed has become difficult because of the compactness of soil consequent to heavy grazing. Grazing after harvesting makes the area bare of any vegetal cover just before monsoon and due to imperviousness of the soil, water from first monsoon showers runs off without much obstruction and carries away loose top soil, if any. Grass production under the circumstances suffers considerably and grass yield is consequently poor. The average production of grass from these *vidis* is about 300 to 350 Kg per ha.

Improvement Works

3.1 The management of grasslands (*vidis*) was entrusted to the Forest Department from the year 1959. Prior to this period the *vidis* were looked after by a small section in the district collectorate with a Grass Officer in charge of the whole district and the *vidis* of each *taluk* in charge of a grass clerk. These officials did not have any technical training or background of grassland management and were just picked up from the Revenue cadre of each district. Their principal duties involved looking after the *vidis*, organising collection of grass from the reserved *vidis*, its baling and the storage in available godowns or *ganjis* and its distribution to the scarcity affected areas. No real efforts were made to improve or develop the existing resources.

3.2 Immediately after taking over of the management of the grassland by the Forest Department, various steps for grass improvement works and construction of godowns etc. were taken. In the first two years, i.e. 1959-60 and 1960-61, improvement works were carried out over 600 ha. These works were of the nature of deepening of tanks and wells in *vidi* areas, soil conservation measures like construction of check dams and digging of trenches in undulating areas and ploughing in flat areas and sowing grass seeds, etc. Trench-cum-live hedge fencing was done over the area undertaken for improvement works in 1960-61 and thereafter. Sowing of seeds of local grasses was done. These are: *anjan* (*Cenchrus ciliaris* Linn.), *saniyar* (*Setaria Sulcatum* (Hack.) A. Camus), *zinzvo* (*Eoethriocloa ischaemum* (Linn.) Keng), etc.

3.3 The scheme was continued basically in the same form during the Third Five Year Plan, with introduction of few changes in the nature of:

- (i) augmenting seeding operations by planting of *tussocks* of perennial grasses,
- (ii) planting of fodder trees to yield leaf fodder,

- (iii) collection of loose stones scattered all over the *vidis* and arranging them in contour lines,
- (iv) clearing of brushwood,
- (v) raising of thorn live hedge to divide the *vidi* into convenient portions for rotational grazing, and
- (vi) chopping of inflorescences of inferior grasses before their seeding to prevent their regeneration.

3.4 In the annual plans and in the Fourth Five Year Plan the activity continued with some changes, viz. complete ploughing in small areas and furrowing with tractor and seeding and sodding with superior grass seeds and tussocks respectively. This, however, did not give very encouraging results mainly because the survival of grass seedlings was unsatisfactory due to long dry spells during the rainy season.

3.5 The achievement in terms of physical and financial targets during the various five year plans and the annual plans is summarised as under :

Item	Achievement during									
	First Plan		Second Plan		Third Plan		Annual Plans		Fourth Plan	
	*phy	*fin	phy	fin	phy	fin	phy	fin	phy	fin
grass improvement works (ha)	600	..	2,500	..	768	..	960	..
fencing around <i>vidis</i> (phy: km										
fin:Rs.lakhs)	2.52	48	9.41	201.6	12.71	188	18.38
construction of grass godown (fodder banks) (numbers)	11		5		17		10	

Evaluation of the work done

4.1 One single factor which has undoubtedly helped the growth of grass is the fencing of *vidis*. Fencing has given the protection badly required by these areas from illicit grazing particularly when the areas were supposed to have been closed to grazing and from uncontrolled grazing after harvesting of grass. The programme of fencing which in the initial years was resorted to only around the area actually under development was extended to cover all the *vidis* in the State so as to completely fence them by a trench-cum-live hedge fence or stone wall, where digging was not possible, to protect from stray cattle. The fencing programme around the *vidis* was initiated in the Third Five Year Plan and was further intensified in the annual plans period and in the Fourth Five Year Plan. By the end of the Fourth Five Year Plan fencing over a length of 437 km around the *vidis* has been completed.

4.2 The fencing has helped in quantitative stocking of the area and has also improved to a certain extent physical condition of the soil. But the im-

* phy—physical ; Fin—financial

provement in qualitative stocking and physical condition of the soil has been extremely slow. The grass seeds and the grass sods of superior variety planted have proved difficult to establish because of scanty rainfall and long periods of drought between the two spells of rainy periods. Ploughing in small strips or making saucer type pits at long distances has also not helped significantly to improve moisture absorption and retention capacity of the area. However, the improvement due to soil conservation measures, such as gully plugging and check damming, has given good results, and along banks of gullies where these works have been undertaken grass growth has considerably improved. By the end of the Fourth Five Year Plan improvement works in 4,628 ha. has been completed. During the same period 46 new grass godowns (fodder banks) have been constructed, thus increasing the storing capacity by 9.2 million Kg of hay.

4.3 Experience has shown that :

- (1) Effective control over time of grazing and the number of heads of cattle is essential to keep the physical condition of the range in a good condition.
- (2) Production of the grass is increased if the precipitation in the area is not allowed to run-off excessively.
- (3) Survival and ultimate establishment of sods and seeds of superior grasses planted can be improved if water retention capacity of the area is improved to tide over the drought period between two spells of rainy periods.
- (4) Grass production can be improved if competition from inferior grasses and shrubs is reduced, and if loose stones are removed marking more land available for grass growth.

Technical details of the works undertaken

5.1 The technique for the scheme for improvement of grasslands now consists of the following operations :

- (i) Stone wall or trench-cum-live hedge fencing : Stone wall fencing has given better results to ward off grazing pressure. Such fencing is prepared by arranging loose flat stones available locally. Wall is 90 cm wide at the base and 50 cm at the top and is 90 cm in height. The trench-cum-live hedge fence consists of a trench, 120 cm broad at the top, 60 cm at the bottom and 60 cm deep. The excavated soil from the trench is heaped on the inner side of the trench and on this loose soil thorny species, like *Euphorbia*, *Acacia* and *Prosopis* are raised.
- (ii) Gully plugging and check damming : Gully plugs are usually constructed in small *nallas* and ravines to arrest and slow down the flow of each storm run-off and are prepared out of loose stones. Check dams are built in flat *nallas* to retain water.
- (iii) Gradony type trenches : These are continuous trenches — 400 to 600 running metres per hectare — prepared in undulating areas along the contour. Soil from the slope is dug to a width of 1 metre and depth depending on the gradient. The dug up soil is heaped on the downward slope to give a flat step of about 1.5 metre width with 10

per cent inside inclination along contour. Soil on this step is dug and loosened and is used for planting grass sods and seeds of superior variety. Normally the distance between the two trenches is about 15 to 17 metres. These trenches collect most of the precipitation, as absorption of water is better in dug up soil.

- (iv) Eradicating weeds and inferior grasses: Weeds are cut before and after the monsoon. Inferior variety of grasses are cut or scorched before they seed.
- (v) Collecting loose stones and arranging these along contours between two gradony type trenches: Loose stones are collected and arranged along the contour between the two trenches. This makes not only more area available for grass to grow but also reduces the velocity of run-off and holds up washed off soil.
- (vi) Sowing of grass seeds supplemented with planting of grass species of superior variety of grasses in the gradony trench area: Grasses of superior variety are raised in nursery and planted in the gradony trenches during and soon after first heavy showers. Grass seeds are mixed with farmyard manure (cowdung) pulverised, and by adding water a paste is made. Small pellets of this paste are prepared and dried in the sun. These pellets are sown 60 cm apart in the gradonies. This method is found to have the following advantages:
 - (i) Grass seeds are not eaten or taken away by ants and insects after sowing.
 - (ii) Water retention capacity of cowdung pellets is better than the surrounding soil. This helps survival of grass seedlings during the long dry periods during the rains.
 - (iii) Better nutrition is available to the grass seedlings in the initial period of establishment.

Cost of operations

6.1 The costs (1973 price level) are given below :

- | | |
|--|------------------|
| (i) Stone well or trench-cum-live hedge fencing construction | Rs. 3,000 per km |
| (ii) Gully plugs and check dams | Rs. 100 per ha |
| (iii) Gradony-type trenches-400 to 600 running metres per hectare | Rs. 125 per ha |
| (iv) Eradication of weeds and inferior grasses | Rs. 10 per ha |
| (v) Collection of loose stones and arranging them along contours between two gradony-type trenches | Rs. 10 per ha |
| (vi) Sowing of grass seeds supplemented with planting of grass species of superior variety of grasses in the gradony trench area | Rs. 50 per ha |

APPENDIX 42.13

Common Tree Species Found in Andaman & Nicobar Islands

Commercial name	Botanical name
A. Ornamental species	
chooi	<i>Sageraea elliptica</i> Hook f. & Th.
marblewood	<i>Diospyres marmorata</i> Parker
padauk	<i>Pterocarpus dalbergioides</i> Roxb.
satfinwood	<i>Murraya paniculata</i> (L.) Jack
silvergrey	<i>Terminalia bialata</i> (Roxb.) Steud. ex Kurz
B. Hard Wood species	
badam	<i>Terminalia bialata</i>
black chuglam	<i>Terminalia manii</i> King
chikrassy	<i>Chukrasia velutina</i> W. & A.
gangaw	<i>Mesua ferrea</i> Linn.
gurjan	<i>Dipterocarpus</i> spp.
Hill mohwa	<i>Madhuca butyraceae</i> Roxb.
jhingan	<i>Pajanelialongifolia</i> (Willd.) K. Scoom.
jungli aam.	<i>Mangifera andamanica</i> King
kala lakuch	<i>Artocarpus gomeziauns</i> Wall. ex Trec.
koko	<i>Albizia lebbeck</i> (Linn.) Benth
lakuch	<i>Artocarpus Lakooncha</i> Roxb.
lalchini	<i>Amoora wallichii</i> King
mau	<i>Duabanga grandiflora</i> (Roxb.) Walp.
nabe.	<i>Lannea coromandelica</i> (Houtt.) Meur.
poon	<i>Calophyllum inophyllum</i> Linn.
pyinma	<i>Lagerstroemia hypoleuca</i> Kurz
red jhingan	<i>Prunus martabanica</i> Kurz
red bombwe	<i>Planchonia andamanica</i> King
red dhup	<i>Parishia insignis</i> Hk. f.
sea mohwa	<i>Manilkara littoralis</i> (Kurz) Dub.
teinkala	<i>Nauclea gageana</i> King
thingan	<i>Hopea odorata</i> Roxb.
toung peine	<i>Artocarpus chaplasha</i> Roxb.
white chuglam	<i>Terminalia procera</i> Roxb.
ywegyi	<i>Adenanthera pavonina</i> Linn.
C. Soft Wood species	
ailanthus	<i>Ailanthus kurzii</i> Prain
bakota	<i>Endospermum chinense</i> Benth.
bombeza	<i>Albizia chinensis</i> (Osbeck) Merr.
chhathian	<i>Alstonia scholaris</i> R.Br.
didu	<i>Bombax insigne</i> Wall.

Commercial name	Botanical name
evodia	<i>Eoudia glabra</i> Bl.
kadam	<i>Anthocephalus chinensis</i> (Lam.) A. <i>Rich ex</i> Walp.
Iambapathi	<i>Planchonella longipetiolata</i> (King et Prain) H.J. Lam.
letkok	<i>Pterygota alata</i> (Roxb.) R.Br.
mayanin	<i>Zanthoxylum rhethra</i> (Roxb.)DC.
papita	<i>Pterocymbium tinctorium</i> (Blanco) Merr.
thitook	<i>Tetrameles nudiflora</i> R. Br.
white dhup	<i>Canarium euphyllum</i> Kurz
yemane	<i>Gmelina arborea</i> Roxb.

APPENDIX 42.14

(Paragraph 42.13.27)^a

Berthing Facilities Available or Being Developed in Different Ports of the Andamans & Nicobar Islands (as in November 1975)¹

(i) Diglipur (North Andaman Island): A berthing jetty of 36 metre length and 10 metre width capable of taking alongside 4 metre draft vessels, connected by a 85 metre long and 4 metre wide approach jetty, has been completed at this site and commissioned in March 1971. The jetty is founded on RCC piles and superstructure with timber decking. One of the oldest settlements is situated at Diglipur and a regular weekly ferry connects it with Port Blair.

(ii) Mayabunder (North Andaman Island): A berthing jetty of length 48 metre and width 12 metre having 9 metre water alongside at LWEST connected by an approach jetty of length 54 metres and width 6 metre has been completed. The jetty is founded on Reinforced Cement Concrete piles and has RCC superstructure and decking. As Mayabunder comes in Port Blair/Calcutta shipping route, this jetty, with 9 metre draught and suitable for berthing mainland vessels, will provide a direct link for people of Middle and North Andamans with the mainland and lead to the rapid development of this area.

(iii) Rangat (Middle Andaman Island): The existing jetty at this site does not have enough depth of water alongside to take in 4 metre draft inter-island vessels. Surveys and investigations to strengthen and realign the jetty, and provide a new berthing arm, were carried out and work taken up.

(iv) Havelock (Havelock Island): A berthing jetty of length 33 metre and width 12 metre having 6 metre water alongside at LWEST, connected by a 33-metre long and 4 metre wide approach jetty, has been completed at this island and commissioned in June 1970. The jetty is founded on RCC piles with RCC superstructure and timber decking and is in use by the inter-island vessels.

(v) Neil (Neil Island): A timber jetty to cater for inter-island ferry vessels founded on timber piles has been completed in August, 1968. Further works to replace the piles by concrete pillars, and to construct a new berthing arm of 28 metre length and 6 metre width, were taken up and completed in February, 1973.

(vi) Port Blair (South Andaman Island): Port Blair is the administrative headquarters of the Andaman & Nicobar Islands. Facilities for both inter-island and mainland/island ships have to be provided at Port Blair. The following works have been taken up:

- (a) Chatham Wharf: The timber jetty at Chatham island where all the mainland ships berth was in a dilapidated condition and required a tremendous lot of repairs very frequently, often leading to disruption of traffic. Work on replacing this jetty by a 130 metre long, 23 metre wide wharf founded on RCC piles with RCC beams and slabs has been completed. A port signal tower has also been constructed at Chatham island.

¹ Based on information obtained from the Chief Engineer, Andaman Laccadives Harbour Works, Ministry of Shipping and Transport (Transport Wing), Government of India.

- (b) Foreshore works at Haddo Wharf: For the foreshore works at Haddo Point in Port Blair the different machineries like crane etc. have been ordered. Works on construction of passenger-cum-cargo sheds, transit sheds, internal roads etc. in phase I have been completed.
- (c) Construction of Wharf at Cholunga Jetty site: Work on construction of wharf founded on RCC piles with RCC beams and slabs at the old Cholunga jetty site at Phoenix Bay in Port Blair has been completed. This 63 metre long and 12 metre wide wharf with 5 metre depth of water alongside is to provide facilities for inter-island ships of 4 metre draft.
- (d) Construction of Slipways: A marine railway type slipway founded on RCC piles with RCC beams, capable of taking ships of 300 tonnes unladen weight, is under construction at Phoenix Bay. This slipway when completed will have 3 slips and will enhance the repair facilities of ships at Port Blair.
- (e) Fisheries Harbour: A fisheries jetty having an approach arm of length 231 metre and width 6.60 metre initially, and 8.75 metre subsequently, capable of berthing fishing launches having 2 to 5 metre draft, has been completed and a berthing jetty of 60 metre length and 14 metre width having 7 metre depth of water alongside is under construction. The entire jetty is founded on RCC piles with RCC superstructure, beams and slabs.

(vii) Hut Bay (Little Andaman Island): At Hut Bay of Little Andaman, an island about 128 km south of Port Blair, construction activities are in progress for construction of a permanent jetty and a breakwater. Little Andaman was a virgin island inhabited only by a few Onges, but was found to be ideally suited for settlement of refugees and accelerated development. Accordingly following harbour development and other construction activities were started:

- (a) Permanent Jetty: A jetty with an approach arm of 171 metre length and 6 metre width founded on RCC piles with timber decking and berthing arm of 175 metre length and 11 metre width founded on RCC piles with RCC decking has been completed. The depth of water alongside the berthing jetty will be 6 metre.
- (b) Breakwater: A 1200 metre long rubble mound breakwater to provide a sheltered basin during the north-east monsoon is under construction. This hockey stick-shaped breakwater will have 8 ton tetrapod armouring and will require over one million tonnes of stones for completion. The initial 100 metre open trestle approach founded on RCC piles and 960 metre of rubble mound breakwater including tetrapod armouring have been completed.

(viii) Car Nicobar (Car Nicobar Island): Surveys and investigations were carried at Car Nicobar for providing harbour facilities and based on this, proposals were formulated. Work on construction of a jetty at Malacca to cater to launches during south-west monsoon has been completed. Proposals for the construction of jetty at Mus to cater to ships during north-east monsoon have been finalised.

(ix) Kamorta (Kamorta Island): An approach jetty of length 51 metre and width 4 metre, and a berthing jetty 60 metre long and 10 metre depth of water alongside, is now completed. The entire jetty is founded on RCC piles with timber decking.

(x) Katchall (Katchall Island): At Katchall an 'L' shaped jetty founded on RCC piles and RCC decking, with a 58 metre long and 4 metre wide approach, and 44 metre long and 10 metre wide berthing portion was completed in March, 1973. The berthing face has 8 metre depth of water alongside.

(xi) Campbell Bay (Great Nicobar Island): The Great Nicobar island is the southern-most island of the Andaman & Nicobar group and is hardly 128 km away from Sumatra. Harbour facilities have been planned at Campbell Bay of this island. The approach portion of the jetty founded on RCC piles which is 217 metre long having a width of 4 metre for first 100 metre length and 6 metre for 117 metre length has been completed. The structure is founded on RCC piles with timber and RCC docking. The berthing portion of the jetty, 71 metre long and 12 metre wide on RCC piles, with RCC decking, will have a depth of water of 6 metre alongside when completed.

APPENDIX 42.15

(Paragraph 42.14.5)

Composition and Functions of the Central Forestry Commission

A. RESOLUTION NO. 3-13/62-FD DATED 25TH AUGUST, 1965

Government of India in the Ministry of Food & Agriculture have been impressed with the necessity of coordination at the technical level among personnel and agencies engaged on the management and development of forests in India. Such coordination is desirable not only among the State departments concerned with Forestry but also with such bodies as the Central Soil Conservation Board, River Commissions and Central Flood Control Board. The Government of India have, therefore, decided with the concurrence of the State Governments and on the advice of the Central Board of Forestry to set up a "Central Forestry Commission" with Headquarter at Delhi.

2. The constitution and functions of the Central Forestry Commission hereafter called the Commission will be as follows:

Constitution:

Chairman: Inspector General of Forests, Ministry of Food & Agriculture, Government of India.

Members: Four members — One member drawn from each of the under-mentioned regions:

(a) Eastern Region:

Assam, West Bengal, Bihar, Nagaland and Orissa, and the Centrally administered areas of Manipur, Tripura, NEFA and Andaman & Nicobar Islands.

(b) Northern Region:

Uttar Pradesh, Punjab, Himachal Pradesh and Jammu & Kashmir.

(c) Western Region:

Gujarat, Maharashtra, Rajasthan, Madhya Pradesh and Goa.

(d) Southern Region:

Madras, Mysore, Kerala and Andhra Pradesh.

The members would be serving officers of the rank of Chief Conservators of Forests. They would be drawn from each region by rotation, and would serve on the Commission generally for a period of three years. The Commission will meet once in three months. The Government of India would provide the Commission with a whole time Secretary and also other essential staff.

Note : The members will draw their pay and allowances from their respective States.

Functions :

- (i) To study the implementation of the National Forest Policy by the State Governments and Union Territories Administrations and to make suggestions where necessary;
- (ii) To make suggestions, if any, for improvement in the preliminary stage of the major Working Plans of the States and Union Territories;
- (iii) To collect, standardise and publish statistics relating to forestry;
- (iv) To pool and disseminate technical information on forestry derived from States and foreign countries;

- (v) To conduct market studies on timber and other forest products and their utilisation;
- (vi) To provide liaison between the Central Soil Conservation Board, the Advisory Board on Research, the River Commission, the Central Flood Control Board and the other agencies whose work has a direct or indirect bearing on forests and forest developments; and
- (vii) To render assistance and technical advice in the implementation and evaluation of the forestry development programmes in the States and Union Territories.

The Commission will be a technical body and will be responsible to the Central Board of Forestry. It will carry out its functions in accordance with the general directions issued by the Board in this regard from time to time. It will function purely as an advisory and liaison body and will ensure that its activities do not, in any manner, interfere with the authority of the State Governments and the Union Territories Administrations in the administration of the forests lying within their territorial jurisdictions.

B. RESOLUTION NO. 7-3/71-FSC DATED 19TH MAY, 1972

The Government of India in the then Ministry of Food and Agriculture (Department of Agriculture) had constituted a Central Forestry Commission for coordination at the technical level among personnel and agencies engaged on the management and development of forests in India, vide Resolution No. 3-13/62-FD dated 25-8-1965. Its constitution provided for membership from the Eastern, Northern, Western and Southern regions. In view of the constitutional changes and creation of new States/Union Territories since then, it has become necessary to reorganise the four regions. Accordingly in partial modification of the Resolution of 25-8-1965, it has been decided to reconstitute the existing regions as follows :

- (1) Eastern Region :
Assam, Meghalaya, Nagaland, Manipur, Tripura, West Bengal, Bihar, Orissa and Centrally administered areas of Mizoram, Arunachal Pradesh and Andaman & Nicobar Islands.
- (2) Northern Region :
Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir and Centrally administered areas of Delhi and Chandigarh.
- (3) Western Region :
Gujarat, Maharashtra, Rajasthan, Madhya Pradesh and Centrally administered areas of Goa, Daman and Diu and Dadra and Nagar Haveli.
- (4) Southern Region :
Tamil Nadu, Mysore, Kerala and Andhra Pradesh.

APPENDIX 42.16

(Paragraph 42.14.14)

Management Norms in Maharashtra and Uttar Pradesh

Maharashtra :

In Maharashtra, it was suggested that a divisional change should be demarcated on the basis of cumulative indices, based on intensity of working, extent of departmental or cooperative societies working, annual plantation targets, revenue, expenditure, vulnerability of forests, etc. The unit index for different aspects are :

	Unit index equivalent Rs.	Remarks
(1) intensity of working :		
(a) intensive management—		
(i) concentrated system of re-generation	30,000 ha	proportionate adjustment to be made, as different intensities of working obtained in the same division. 1 Sub-DFO in addition for each 300 ha. 1 Range Forest Officer for each 400 ha, 1 Forester for each 100 ha & 1 Forest Guard for each 50 ha or so.
(ii) coppice and selection system	80,000 ha	
(b) extensive working on protection only or open pastures etc.	200,000 ha	
(2) plantation targets—		
(a) other than bamboo plantations	400 ha	
(b) bamboo plantations . . .	1,200 ha	
(3) revenue—		
(a) inaccessible or poor forests .	5.00 lakh	
(b) mixed timber and teak pole forests.	10.00 lakh	
(c) teak forests	25.00 lakh	
(4) expenditure (exclusive of expenditure on plantations and cost of machinery)—		
(a) intensive management . . .	5.00 lakh	
(b) extensive management . . .	2.50 lakh	
(5) other facts—		
forests vulnerable to adverse influences, compact nature of forests, etc.		consideration to be given on individual merits.

Indices are to be calculated for each category and totalled. Ordinarily a count of 4 indices should be construed as a normal divisional charge. A count exceeding 6 will justify splitting of the division. On the foregoing conclusion, divisional charges in Maharashtra may vary in extent from 25,000 ha to 150,000 ha. Each division will be assisted by one or more gazetted assistants depending upon the intensity of work.

The forest ranges, rounds (Foresters' charges), beats (Forest Guards' charges) are generally demarcated from the protection point of view. The suggested norms for these are :

Category of problem area	Forest Guard's charge	Forester's charge	Range Forest Officer's charge
reserved or protected forests under regular management.	..	..	ordinarily 4 rounds (Foresters' charges)
(i) vulnerable to adverse influences.	750 ha	2 to 3 beats.	important ranges that cannot be split into optimum size would be assisted by an Additional Ranger.
(ii) distant from habitation and in the interior free from adverse influences.	1,000 ha 1,250 ha	3 to 4 beats	
reserved or protected forests not under regular management.	1,500 ha to 2,000 ha	4 beats	
plantation along canals and railways—			
(a) established crops . . .	30—50 km	ordinarily	
(b) not established . . .	15—25 km	4 beats	

Sub-divisional Forest Officers are also suggested in case of departmental operation (for each 7,000 cu m or so) with additional Range Forest Officers (one each for 1,500). For soil conservation works also, extra staff (Assistant Conservator of Forests assisted by field staff) are suggested.

Uttar Pradesh :

Introduction of intensive management was suggested through the implementation of the following measures :

- (i) conversion of low value natural forest into quick growing high yielding plantation crops;
- (ii) enhancement of productivity of forests through frequent and intensive tending operations; and
- (iii) development of communications.

It is proposed to attain, in 2-3 phases, the intensive standards advocated by FAO and Prof. Lundqvist, FAO Expert.

These standards are :

- (i) extensive management — 1 officer, 3 Forest Rangers and 12 Forest Guards for every 20,000 ha;
- (ii) establishment and maintenance of plantations — 1 officer for every 1,000 ha to be planted up annually;
- (iii) size of a division for plantation forestry — 12,000 to 20,000 ha;
- (iv) logging operation — 1 officer, 2 Forest Rangers and 10 Foremen for every 20,000 cu m felled per year; and
- (v) development of communication — 1 Engineer with supporting staff for every 50 km or so of roads per year.

The first step in the intensification is to classify the divisions on the basis of work-loads into three categories (I. Intensive, II. Intensive/Extensive, and

III. Extensive) and allot an index number on the basis of an yardstick. This is done for each of the following four types of work:

Type of Work	Unit index equivalent	Categorisation
Silviculture and management		
(a) intensive—		
(i) concentrated regeneration with seed <i>sal</i> .	20,000 ha	I. intensive—if intensive <i>sal</i> working circle contribute to more than 50 per cent.
(ii) concentrate regeneration with conifers.	40,000 ha	II. intensive/extensive—if intensive and extensive <i>sal</i> w.c. contribute equally or if intensive conifers w.c. contribute 50 percent or more.
(iii) concentrated regeneration from coppice.	80,000 ha	III. extensive—other cases.
(b) extensive—		
(i) selection system etc.	80,000 ha	
(ii) protection, grazing, etc.	160,000 ha	
plantation activities	400 ha	I. annual area 1.0 unit index and over II. annual area 0.5 to below 1.0 unit index III. annual area—less than 0.5 unit index
revenue—		
(i) Himalayan & Vindhyan region	Rs. 10.00 lakh	same as in the case of plantations Do
(ii) <i>erai bhabar</i> in plains	Rs. 40.00 lakh	
expenditure—		
(i) Himalayan & Vindhyan region	Rs. 5.00 lakh]	Do
(ii) <i>terai bhabar</i> in plains	Rs. 10.00 lakh	Do

The question whether a division is manageable or needs splitting is decided on the basis of the highest index out of the 4 indices. If the value exceeds 1.5, there is a definite case for regrouping, unless there are exceptional circumstances for maintaining the *status quo*. Unlike in Maharashtra, any one type of work may indicate necessity for splitting or regrouping.

Another important field where norms of Uttar Pradesh differ from those in Maharashtra is the suggestion to create the posts of Sub-Divisional Officers in a division, instead of having gazetted assistants in the division only. It is stated that the gazetted assistants mainly carry out the jobs allotted to them by the DFO from time to time, and that this system does not permit the most effective use of the services of the highly trained ACF's. It was, therefore, proposed to create at least one sub-division in each division to be placed directly under the charge of the ACF who should be empowered to exercise most of the powers of the DFO in the area placed under his control. This will normally be half of the area of the division, and over the rest of the area the DFO will continue to function as before.

MINOR FOREST PRODUCE

1 INTRODUCTION

43.1.1 Forests are a source of a variety of 'minor' forest products. These meet the indispensable requirements of the population, particularly of those who live in or near the forests. Also, there are cottage—small—and medium-sized industries where certain 'minor' forest products are processed. Some of the products in this category constitute a significant part of the commodities for export. There is a great potential for these products to contribute to the economy of the nation. For this, it is desirable to increase production, organise proper methods of collection and grading, develop a fair system of marketing and distribution, ensure proper utilisation, maximise foreign exchange earnings and augment the employment opportunities of tribals and others living in and around forests. The measures to be taken for the development of minor forest products, both from economic and social aspects, have been elaborated in this chapter.

2 PRODUCTION—ACTUAL AND POTENTIAL, DEMAND, COLLECTION AND PROCESSING

43.2.1 Minor forest produce/products* include all products obtainable from forests other than wood. These products have assumed great importance in recent years. The visible contribution of MFP to the total revenue of Forest Departments in India has been 30.2, 31.0 and 28.9 per cent respectively in the years 1967-68, 1968-69 and 1969-70. In actual terms, the revenue from MFP was about Rs. 36 crores in a total forest revenue of about Rs. 125 crores during 1969-70. However, much of the MFP is allowed to be removed free or at concessional rates by tribals, agriculturists, etc. The gross value of output from MFP in 1969-70 was estimated to be Rs. 108.08 crores at current prices¹.

* Hereafter abbreviated form 'MFP' will be used to indicate the minor forest produce/products.

¹ 1975 (March) National Accounts Statistics, 1960-61 to 1972-73, Disaggregated Tables Table 2.1. New Delhi, Central Statistical Organisation, Government of India.

43.2.2 The MFP may be classified as follows:

- (i) fibres and flosses,
- (ii) grasses (other than oil-producing), bamboos, reeds and canes,
- (iii) essential oils,
- (iv) oilseeds,
- (v) tans and dyes,
- (vi) gums, resins and oleoresins,
- (vii) drugs, spices, poisons and insecticides,
- (viii) leaves,
- (ix) edible products,
- (x) lac and its products, and
- (xi) other products.

Some of the important MFP are discussed in this chapter.

43.2.3 Reliable statistics of the outturn of various kinds of MFP are not available. As a result, the Indian Forest Statistics do not contain data on the production of MFP in physical terms; only monetary values are given. Again the quantities given away free or at concessional rates to villagers and right-holders are rarely calculated with any accuracy. The extraction of MFP in physical terms as well as in varieties is certainly increasing. In 1958-59, the revenue from the minor forest produce accruing to Forest Departments was Rs. 10 crores; it went upto Rs. 16 crores in 1964-65 and Rs. 36 crores in 1969-70. Even after accounting for the increase in the price index, the increased revenue could have come from increased production as well as from more efficient methods of collection. The estimates of production of, and demand for, a few items of MFP, which follow, have been based on various studies made by different agencies as well as from records maintained in the Forest Research Institute (FRI), Dehra Dun.

Fibres and Flosses

43.2.4 Fibres are obtained from the bast tissues of certain woody and succulent species. Mostly they are coarse and used for rope making. Flosses are obtained from certain fruits and used for stuffing pillows, mattresses, etc. The commonest floss in India is that from *semul* (*Bombax ceiba* Linn.). *Semul* grows extensively throughout the Indian plains and the Deccan plateau. It is also planted in forest plantations in many parts of the country for its value as a source of matchwood. The flosses from fruits of *kapok* (*Ceiba pentandra* (Linn.) Gaertn. syn. *Eriodendron anfractuosum* DC.) are

elastic, buoyant and resistant to water absorption. They are, therefore, used for making life-belts.

43.2.5 As regards fibres, *sisal* hemp (*Agave sisalana* Perrine) is usually grown to demarcate the plantations by the Forest Departments or in soil conservation works. In Chapter 22 on Commercial Crops, we have discussed agave extensively. The present production is estimated to be about 2,500 tonnes. The total requirement at present has been calculated to be 22,400 tonnes, and it is expected to be doubled by 2000 AD. Good scope exists for planting agave in firelines, nursery and plantation boundaries, clearances under transmission lines, etc. These plantations would make it possible to utilise fully the potential of such areas. However, it would not be desirable to raise pure plantations of agave in areas available for raising tree plantations.

43.2.6 India produces about 3,000 tonnes of *kapok* floss annually almost all of which is consumed locally. The world production is estimated to be 65,000 to 95,000 tonnes annually. Previously large quantities of *kapok* floss were imported by European countries and USA for use as a stuffing material, but the relative cheapness of foam rubber in the importing countries and development of spring mattresses have resulted in a decline in demand. There is, however, still some demand for *kapok* for general upholstery and life jackets. As a thermal and acoustic insulator *kapok* has been largely replaced by fibre glass. In spite of all this, there is bound to be a considerable local demand for *kapok* floss for stuffing mattresses and pillows, and thus the raising of *kapok* plantations would be paying. *Kapok* trees are at present planted abundantly in Kerala and adjoining tracts. This should be encouraged in concentrated patches in high rainfall areas to enable collections of *kapok* floss economical. Canal banks, road sides, edges of plantations and other such areas lend themselves for concentrated *kapok* plantations.

Grasses (other than oil-producing) and Bamboos

43.2.7 Annually 60,000—80,000 tonnes of *sabai* grass (*Eulaliopsis binata* (Retz.) Hubbard) are collected, processed *in situ* and supplied to the paper mills. In view of the increasing use of hardwoods and the creation of plantations of fast growing species, *sabai* is losing its importance for paper making. It would, however, still retain some importance locally for rope making, and we are sure the existing *sabai* areas would be maintained in proper shape as long as the economics of the demand and supply work out in favour of the grass. We do not visualise much rise in its demand. The subject of

forage grasses in forest areas has been dealt with in Chapter 42 on Production and Social Forestry.

43.2.8 About 80 per cent of bamboo produced is utilised in other ways than in industries. The availability of bamboo was estimated by the Committee on Natural Resources, Planning Commission¹. It was found that bamboos occur over a forest area of about 100,270 sq. km. The figures for current and potential availability from Tamil Nadu and Manipur were not available. Excluding these two States, the current removal and potential availability were reported (in 1965) to be about 1.60 and 4.00 million tonnes respectively. It was found by the Committee that of the total quantity removed, construction accounted for 32 per cent; rural use, 30 per cent; packaging, 7 per cent; paper pulp, 17 per cent; and other uses, 14 per cent. The present methods of exploitation are far from satisfactory. As a result, not only the outturn of bamboos has decreased but they have altogether disappeared from certain forests. In the interest of meeting the agricultural, commercial and industrial demands to the maximum extent it would be desirable to systematically survey the bamboo-bearing areas to determine their present production, and then work them strictly according to silvicultural practices to get the maximum sustained yield.

Essential Oils

43.2.9 India produced about 1,475 tonnes of essential oils in 1972-73, of which about 420 tonnes were exported and the rest were utilised by industries manufacturing soaps, detergents, fine chemicals, perfumes, cosmetics, pharmaceuticals, etc. In addition, to meet the demand of the industries about 480 tonnes of essential oils are imported annually. Thus the total consumption of essential oils in the various indigenous industries may be about, 1,550 tonnes. It is estimated that lemon grass (*Cymbopogon flexuosus* (Nees ex Steud) Wats.), rusa or palmarosa (*C. martinii* (Roxb.) Wats. var. *motia*) and eucalyptus oils are the products for which the demand is likely to rise. There would be few constraints in their production, unlike sandalwood oil or agarwood oil, where the raw material available is limited or difficult to produce. Regarding *Eucalyptus*, the rights of collection of leaves of blue gum (*Eucalyptus globulus* Labill.) are auctioned annually. The method of distillation is at present crude and is mainly a cottage industry. Since the price of oil has gone up (the leaves also

¹ 1965. Study on Forest Raw Materials for Pulp, Paper and Newsprint; p 11. New Delhi. Committee on Natural Resources, Planning Commission, Government of India.

fetch a price of over Rs. 200 per ha), it should be possible to maintain a good standard of oil and improve the technique to get more yield. The citriodora oil can similarly be produced on an increasing scale. Karnataka has at present nearly 4,000 ha of *E. citriodora* Hook. plantations of different age classes. The species is pollarded almost annually and maintained as a bush. The oil fetches a price of Rs. 70 per kg. at present. Due to the ease with which the species can be raised, there should be no difficulty to increase the area under plantations of this species.

43.2.10 In addition to *Eucalyptus* leaves, other plants which can be utilised for the production of essential oils are lemon grass and rusa grass, particularly in western Madhya Pradesh and eastern Maharashtra, and khus or vetiver (*vetiveria zizanioides* (Linn.) Nash—a grass) in eastern Rajasthan. The oil production can be increased by tying up industrial utilisation with cultivation. In the case of lemon grass, the high standard of its oil should be maintained by eliminating other varieties of grass. There has been considerable work done on the cultivation of the Java variety of citronella grass (*Cymbopogon nardus* (Linn.) Rendle), which is high yielding and is remunerative. Cultivation of rusa grass can be done anywhere except in the waterlogged areas. Its cultivation has been started as a plantation near Dehra Dun. Demonstration plantations of oil producing grasses but on commercial considerations should be taken up. However, the crude system of distillation which produces inferior quality of oil needs to be improved. The development of industries with respect to production of essential oils should be encouraged. The research and organisational responsibilities in respect of plants yielding essential oils have been considered in Chapter 23 on Horticultural Crops. We have recommended therein that the ICAR would be responsible for plant research but the research on processing should continue to be the responsibility of the Central Indian Medicinal Plant Organisation under the CSIR. The FRI, however, should continue to deal with multiplication and distribution of seed material of the plants of forest origin.

43.2.11 There is a great future for linaloe (*Bursera penicillata* (Sesse et Moc. ex DC.) Engl. syn. *B. delpechiana* poiss. ex Engl.). There are nearly 120 ha of *Bursera* plantations of a private party and 800 ha of Government plantation in Karnataka. The oil fetches nearly Rs. 150 per kg.

43.2.12 Indian sandalwood oil is obtained by distillation of heartwood of sandal (*Santalum album* Linn.), an evergreen parasitic tree. The important sandalwood producing States are Karnataka, Tamil Nadu and Andhra Pradesh and, to a lesser extent, Kerala. The total quantity of sandalwood produced annually by these States is about

4,200 tonnes, of which Karnataka produces about 2,400 tonnes, Tamil Nadu 1,000 and Andhra Pradesh and Kerala 400 each. Sandal trees also grow in some parts of Maharashtra and Indore region of Madhya Pradesh but the production from these areas is negligible. Except in Karnataka, Tamil Nadu and Andhra Pradesh, there are no rules to regulate possession and transport of sandalwood in other States, with the result that it is difficult to regulate or check the inter-State smuggling of the wood. It is believed that considerable quantities of smuggled sandalwood find their way to the large number of private distilleries in Tamil Nadu, Andhra Pradesh, Kerala, Gujarat and Uttar Pradesh. In order to overcome this, there should be a uniform legislation on the possession and transit of sandalwood applicable to all the States. Further, it would be better to nationalise the trade in sandalwood and the sandalwood oil distillation industry. Export of sandalwood billets should be gradually reduced. Instead, distillation of oil and the products of cottage industries based on sandalwood carving should be encouraged for export.

43.2.13 Large scale release and clearance of land in recent years in dry deciduous and scrub forests have adversely affected the growth of sandal. Natural regeneration of sandal occurs by dispersal of seeds by birds, but the rodents eat away the seeds and goats browse the sandal seedlings when found in the open. When the seedlings develop under bushes, there is some chance of survival. But the pace of natural regeneration is slow compared to exploitation. Artificial regeneration is generally resorted to in forest areas. The cultivators and other private individuals are also encouraged to plant sandal. The method generally adopted is dibbling of at least 100 seeds per ha on the mounds of trenches dug for the purpose in comparatively open areas. In forest areas seedlings with good host plants are raised in polythene bags and planted in concentrated patches in pits 0.5 m \times 0.5 m \times 0.5 m in size. Protection from grazing is the main problem. It is desirable that increased tempo of artificial regeneration of sandal should be built up in afforestation programmes in these areas. The possibilities of growing sandal in other parts of the country like North Eastern India, Orissa, etc. should be explored.

43.2.14 Heavy mortality of sandal trees due to spike disease is one of the main bottlenecks for increasing the production of sandalwood. The branches of affected trees produce smaller leaves giving the twigs the appearance of a spike. The sandal spike disease has been the subject of research for quite a long time, and divergent views exist as to the nature of the disease. The research on sandal spike disease should be intensified, for finding an effective solution of this problem.

Oilseeds

43.2.15 In recent years, production of cultivated oilseeds has been far short of the demand. There is a need for looking into other sources to bridge the gap between the demand and supply. Seeds of certain trees contain oils, which warrants their collection for utilisation by the soap, paint and varnish industries. The important oilseeds are those of: *mahua* (*Madhuca longifolia* (Koenig) MacBride), *sal* (*Shorea robusta* Gaertn.f.), *karanj* (*Pongamin pinnata*) (Linn.) Pierre), *neem* (*Azadirachta indica* A. Juss.), *kusum* (*Schleichera oleosa* (Lour.) Merr.), *dhupa* (*Vateria indica* Linn.), *nahor* or *nagkeshar* (*Mesua ferrea* Linn.), *undi* (*Calophyllum inophyllum* Linn.), *pisa* (*Actinodaphne hookeri* Meissn.), *khakan* (*Salvadora oleoides* Don.) and *kokam* (*Garcinia indica* Chois.). These trees occur both in the forests and on village lands, roadsides, etc.

43.2.16 *Sal* is an important forest tree—a large sized one—occurring gregariously over extensive areas in Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Madhya Pradesh and in small numbers in Andhra Pradesh. The *sal* seed (kernel) has an oil content of nearly 12½ per cent. The oil extracted from the *sal* seed is now acceptable in the soap industry and its deoiled meal is used as a cattle or poultry feed.

43.2.17 The oils produced from most of the seeds referred to are used in various industries, particularly the soap industry. Some of these, like *mahua* and *neem* oils, are already established industrial raw materials; others like *karanj* and *kusum* have come into large scale use in recent years, while efforts to exploit *sal* seeds as a source of vegetable oil have started bearing fruit since 1968. There are other forest trees and shrubs on the seeds of which research and development work is needed. These are: *dhak* or *palas* (*Butea monosperma* (Lamk.) Taub.), *malkangini* (*Celastrus paniculata* Willd.), *bagbherenda* (*Jatropha curcus* Linn.), *cherupinnai* (*Calophyllum apetalum* Willd.), *kavathi* or *chaulmoogra* (*Hydnocarpus laurifolia* (Dennst.) Sleumer), *arsin-gurgi* (*Garcinia morella* Desr.), *phulwara* (*Diploknema butyracea* (Roxb.) H. S. Lam.syn. *Modhuca butyraceae* Roxb.), *kamala* or *rohini* (*Mallotus philippensis* Muell.-Arg.), *punnai* or *jangali badam* (*Sterculia foetida* Linn.), *pitraj* (*Aphanamixis polystachya* (Wall.) Parkar syn. *Amoora rohituka* W. & A.) *kakamari* (*Anamirta cocculus* (Linn.) W. & A.), *maida lakri* (*Litsea chinensis* Lam.) *harra* (*Terminalia chebula* Retg.), *akhrot* (*Juglans regia* Linn.) and *gokhru* (*Xanthium strumarium* Linn.). These are not yet being exploited on a commercial

scale. It is found that the *palas* seeds contain upto 19 per cent oil, while the deoiled meal contains about 30 per cent protein, but it is toxic. In 1973, a small quantity of *palas* seeds was collected in Maharashtra and the cake was sold to citrus orchards for use as manure. However, further research in the processing of *palas* and other seeds, including removal of toxicity of *palas* seed oil, is necessary, considering that most of the above species have a wide occurrence in India.

43.2.18 The work of exploiting trees for oil purposes has been mainly done by the Khadi and Village Industries Commission for about twenty years. It has established various collecting and processing centres at convenient locations in the midst of the areas of production. Its main emphasis has been on the utilisation of such oils for soap making as a part of its cottage industries' programme. It helped in the establishment of the Non-edible Oils Association at Poona in 1958. The Association organised marketing depots at various places and undertook to supply raw materials needed in soap manufacture for the convenience of participants. The Khadi Commission has established its laboratory at Poona to carry out connected researches and fabrication of required equipment. Despite the interest of Khadi Commission, the progress has not been much because of the factors pointed out in paragraph 43.2.20.

43.2.19 Complete and fully authenticated estimates of the present production and total potential of the minor oilseeds of tree origin in the country are as yet not available, because the trees are found scattered over vast areas in the country and surveys have not been carried out in all parts of the country. Moreover, the yield per tree is subject to considerable variations depending on seasonal conditions and other factors such as the age of the trees. The Directorate of Oilseeds Development, Ministry of Agriculture and Irrigation, Government of India has prepared^{1,2} an estimate of production and potential of nine important oilseeds of tree origin based on the surveys and investigations conducted by the erstwhile Indian Central Oilseeds Committee, Directorate of Oilseeds Development, Khadi and Village Industries Commission and Hindustan Lever Limited. The figures are reproduced in Table 43.1:

¹ 1972 Report of the Study Group for the Formulation of Fifth Five Year Plan Proposals on Oilseeds : p 51, New Delhi. Ministry of Agriculture & Irrigation, Government of India.

² 1971. Report of the Sub-Committee on Minor Oilseeds : pp 3-10, New Delhi. Ministry of Agriculture & Irrigation, Government of India.

TABLE 43.1

Estimated Availability (1970-71) and Total Potential of Minor Oilseeds of Tree Origin

Oil-seeds	Availability (tonnes)		Total potential (tonnes)			Nature of oil
	Seed	Oil	Seed	Yield (per cent)	Total oil production	
<i>mahuā</i>	71,428	25,000	490,000	35	171,000	hard
<i>neem</i>	100,000	20,000	418,000	20	83,600	semi-hard
<i>karanj</i>	25,900	7,000	111,000	27	30,000	semi-hard
<i>kusum</i>	9,000	3,000	90,000	33	30,000	hard
<i>sal</i>	25,000	3,125	5,504,000	12.5	688,000	hard
<i>kokam</i>	500	200	2,000	40	800	hard
<i>khackan</i>	1,687	675	46,300	33	15,400	nut-oil
<i>nakor</i>			5,700	40	2,300	semi-hard/ soft
<i>undi</i>			3,800	60	2,300	semi-hard/ soft
total	233,515	59,000	6,670,800		1,023,400 or 1,000,000	

43.2.20 The potential indicated in the above table does not represent realisable quantities that can be actually harvested with feasible measures. The main bottlenecks in increasing the collection of minor oilseeds of tree and shrub origin and their utilisation in soap making and other industrial uses are as follows:

- (i) low price paid to seed collectors;
- (ii) inadequate organisation for collection;
- (iii) inadequate road communications;
- (iv) lack of storage facilities;
- (v) short period of collection;
- (vi) large amounts of finance required during the short collection period;
- (vii) high cost of processing; and
- (viii) scattered distribution of trees.

If these bottlenecks are removed a large number of States would be able to (a) increase the revenue from forests, (b) offer more employment to the tribals and (c) create greater economic activities in

rural areas. Significant possibilities for developing the source for production of minor oilseeds of tree origin in different States are as follows:

Andhra Pradesh	— <i>mahua neem</i> and <i>kusum</i>
Assam	— <i>sal, nahor</i> and <i>pisa</i>
Bihar	— <i>mahua, kusum</i> and <i>sal</i>
Gujarat	— <i>mahua, neem</i> and <i>khakan</i>
Karnataka	— <i>mahua, neem, karanj, kokam, nahor, undi, pisa</i> and <i>dhupa</i> .
Kerala	— <i>nahor, undi, pisa</i> and <i>dhupa</i> .
Madhya Pradesh	— <i>mahua, sal, kusum</i> and <i>neem</i> .
Maharashtra	— <i>mahua, neem, karanj, kokam</i> and <i>pisa</i> .
Orissa	— <i>mahua, kusum</i> and <i>sal</i> .
Rajasthan	— <i>neem</i> and <i>khakan</i> .
Tamil Nadu	— <i>neem, karanj, undi</i> and <i>pisa</i> .
Uttar Pradesh	— <i>mahua, neem, sal, kusum</i> and <i>khakan</i> .
West Bengal	— <i>mahua, neem, sal</i> and <i>kusum</i> .

43.2.21 We expect that by 2000 AD the limitations can be largely overcome. But some limitations would still exist in the case of *sal*. It may not be possible to have the entire production of *sal* seeds collected because seeds are required in many regions for artificial and natural regeneration. Taking all aspects into consideration, we estimate that the realisable potential of oil production from the seeds of the trees mentioned in Table 43.1 would be of the order of 800,000 tonnes by 2000 AD. In the meantime, other trees and shrubs mentioned in paragraph 43.2.17 may be successfully developed for oil production, and the contribution from this source may be of the order of 400,000 tonnes by 2000 AD. Hence the target of production of oil from minor oilseeds of tree and shrub origin may be placed at 1.2 million tonnes by 2000 AD.

43.2.22 It is worthwhile to note that the present installed capacity for crushing vegetable oilseeds and their solvent extraction is unutilised to the extent of about 50 per cent. The minor oilseeds of tree and shrub origin are available mainly during the months of May, June and July when the availability of major oilseeds is at the minimum. The present installed capacity can therefore take care of a larger quantity of seeds than the present processing of two lakh tonnes. Moreover, there will be no difficulty in increasing the capacity, where necessary. If the crushing of minor oilseeds can be

done during the slack season for major ones, the oil can be marketed at a higher price and economics would improve. The oil production from minor oilseeds to the extent of 1.2 million tonnes would require a crushing of over seven million tonnes of minor oilseeds of tree and shrub origin.

43.2.23 The main utilisation of the *sal* seed oil would be in the soap industry. The economics of any *sal* seed oil extraction plant would improve with the popularity of deoiled *sal* meal for cattle and poultry feed. In a recent study taken up by the Madhya Pradesh Industrial Development Corporation Limited, it was indicated that a 50 tonnes kernel per day plant (which would be roughly a 2,000 tonnes per year oil extraction plant) would be an economically viable unit. The cost of collection of seeds and transport to factory would work out roughly to Rs. 4,000 per tonne of processed oil, and the manufacturing cost, including depreciation, interest, working expenses, etc. would be Rs. 550 per tonne; the total being thus Rs. 4,550 per tonne of processed oil. The selling price of *sal* oil was nearly Rs. 5,000 giving a net margin, in addition to providing 6 tonnes of deoiled meal for every tonne of oil. The solvent extraction process for *sal* seeds would be the same as used for rice bran. Factories which might be set up for oil extraction from *sal* seeds would not face the danger of being shut down in the event of an erratic supply of seeds, due to a bad seed year, railway transport difficulties, etc. They could depend on rice bran or on other oilseeds for keeping them going. Research work on the edibility of *sal* fat has been taken up at the Central Food Technological Research Institute (CFTRI), Mysore since 1970. More work has, however, to be carried out before *sal* fat can be recommended for human consumption. Another line of research, which is showing promise, is the use of *sal* seed fat as substitute/extender of cocoa butter in confectionery, pharmaceuticals, cosmetics and allied industries.

43.2.24 The economics of deoiled meal production, as indicated by the Regional Research Laboratory, Hyderabad, based on a 50 tonnes per day plant of deoiled *sal* meal showed that capital investment required was Rs. 30.0 lakhs. It might be possible to have twentyfive per cent return on total capital investment with per day production of 10 tonnes of solid tannin (45 per cent purity) and 39 tonnes of detanned *sal* seed meal. The Regional Research Laboratory is at present working on obtaining tannins (or developing them) useful for leather industry. If an economic process could be developed for reducing the tannin content of deoiled *sal* meal (about 13 per cent) to 3-4 per cent, the quantum of deoiled *sal* meal that could be incorporated in compound cattle and poultry feeds could be increased very substantially.

43.2.25 Industries using minor oilseeds should be planned in such a way that by 2000 AD a target of production of 1.2 million tonnes of oil is possible through the use of *mahua*, *neem*, *karanj*, *kusum*, *sal*, *khakan*, *kokam*, *nahor*, *undi* and various other miscellaneous oilseeds of tree and shrub origin. Incentives should be given, as found necessary, to the industries for using larger quantities of minor oilseeds, particularly in soap making. The State forest organisations dealing with MFP, as well as the Central organisation for forest planning and development, should maintain a dialogue with the Directorate of Oilseeds Development, Ministry of Agriculture & Irrigation and Ministry of Industries & Supplies. Simultaneously, extension efforts should be directed towards popularising the deoiled *sal* meal for cattle and poultry feed.

Tans and Dyes

43.2.26 A variety of vegetable tanning material is produced in the forests. The chief vegetable tan stuffs are the myrabolan* nuts, barks of wattle (*Acacia mearnsii* De Wild. and *A. decurrens* Willd.), *avaram* (*Cassia auriculata* Linn.) and *babul* (*Acacia nilotica* (L.) Willd. ex Del.). Apart from these, a number of other tanning materials are used by the cottage or small scale tanneries all over the country, such as *dhaura* (*Anogeissus latifolia* Edgew.) leaves and bark, *karada* (*Cleistanthus collinus* (Roxb.) Benth. & Hook.f.) barks, *ghat-ber* or *ghont* (*Ziziphus xylopyrus* Willd.) fruits, *amaltas* or *sunari* (*Cassia fistula* Linn.) bark, *sal* bark, *sain* or *saja* (*Terminalia alata* Heyne ex Roth syn. *T. tomentosa* W. & A.) bark, *arjuna* (*T. arjuna* W. & A.) bark, *amla* (*Emblica Officinalis* Gaertn.) leaves and fruits, *karonda* (*Carissa spinarum* Linn.) leaves, etc.

43.2.27 Fruits of three different species are known in the trade as myrabolan—*harra*, *bahera* (*T. bellirica* Roxb.) and *amla*. However, *harra* or chebulic myrabolan is the most important. *Harra* is a large deciduous tree. The maximum supplies of chebulic myrabolan nuts come from Madhya Pradesh and smaller quantities from Orissa, Maharashtra, Bihar, Andhra Pradesh, Tamil Nadu and Karnataka. The nut is used in the form of an extract or in crushed form.

43.2.28 Wattle bark is obtained from the plantations of the species on the Nilgiri plateau and Palni hills in Tamil Nadu. *Avaram* is a shrub growing wild in Rajasthan, Gujarat, Maharashtra, the Deccan and South India. With the release of wastelands for cultivation, the occurrence of the shrub is shrinking. Its bark is chiefly used in the

* Also spelt as 'myrobalan'.

Madras tannery. *Babul* bark is an important tannin material in Northern India, the main centre being Kanpur. A small sized tree, *babul* occurs in wastelands and is also cultivated.

43.2.29 There is abundant raw material in the form of barks of mangroves in the Andaman & Nicobar Islands, for setting up tannin industry. It is estimated that mangroves occur over an area of approximately 18 per cent of the total area of the Islands. There are also sizeable mangrove forests in the Sundarbans in West Bengal and in Orissa. Cottage and small scale factories exist in Calcutta for utilisation of mangrove barks.

43.2.30 The total annual requirement of vegetable tanning materials by India's leather industry is estimated to be 250,000 tonnes, and in terms of vegetable tan extracts about 50,000 tonnes of myrabolan, 50,000—75,000 tonnes of *babul* and *avaram* barks, and 25,000—50,000 tonnes of other tanning materials. To meet the internal requirement of specific types of tannin, substantial import takes place of such tanning materials and their extracts as are not available in India or produced only in small quantities. Import of wattle bark is steadily increasing both in quantity and value. In 1969-70 about 926 tonnes of bark were imported at a value of approximately Rs. 7.30 lakhs. In 1973-74, the import was about 1,472 tonnes valued at Rs. 13.63 lakhs. Wattle bark tannin extract also constitutes a major drain of foreign exchange. The quantity imported in 1969-70 was about 14,610 tonnes valued at about Rs. 2.35 crores. The price had been rising since then, and in 1973-74 the quantity imported was about 13,380 tonnes valued at Rs. 3.14 crores.

43.2.31 In the case of myrabolan, the FRI put the annual collection in 1967 as shown below:

State	Estimated average annual collection (tonnes)	Percentage of total
Madhya Pradesh	65,000	60.5
Orissa	20,500	19.1
Maharashtra	10,000	9.3
Bihar	4,000	3.7
Andhra Pradesh	3,000	2.8
Others	5,000	4.6
Total	107,500	100.0

The Forest Departments have not made a survey of the occurrence of myrabolan in the States. It is essential that a survey of *karra* tree is taken up to determine (a) the total number of trees of different girth classes and (b) the estimated average yield of drupes per tree. Experiments regarding the successful raising of myrabolan plantations mixed with other species should be undertaken.

43.2.32 It would be useful to introduce certain exotic species for supplementing resources for tannin production. Plantations of wattle, an exotic, are already being raised in the Nilgiri plateau and Palni hills in Tamil Nadu, but the extent of its cultivation is not adequate to meet the demands of the leather industry. Another exotic, *Schinopsis lorentzii* Engl., from Argentina appears to be a suitable species to be introduced in the dry regions for tannin production. This is now being tried in Karnataka.

43.2.33 Rights for collection of myrabolan and other tanning materials are generally sold by public auction or by tender-cum-auction by the Forest Departments. The collection of myrabolan is done by the tribals living in the interior of forests. Due to lack of organised marketing, they do not get a fair remuneration. To encourage larger collection of this commodity and to give the required price incentive to the tribals, the Madhya Pradesh Government has recently nationalised the trade in myrabolan. The quantity collected since nationalisation is given below:

	tonnes
1969-70	13,315
1970-71	23,017
1971-72	53,380
1972-73	18,557

There was a sharp drop in collection in 1972-73, compared to the previous year, because of unutilised stock in hand. Increased collection or development of any produce should never be de-linked from utilisation. To increase the collection for dispensing 'social justice' would be a self-defeating exercise in the long run without 'growth' of relevant industries. It may be mentioned that while in 1970-71 Madhya Pradesh had five units for the crushing of myrabolan with an installed capacity of 24,000 tonnes, the actual production did not exceed 600 tonnes, in spite of a good demand for the crushed product in the export market. This shows a lack of coordination between the Forest Department which produces the raw material and other agencies dealing with industry and export.

43.2.34 Different varieties of myrabolans are known by the names of growing areas and the marketing centres, such as Jabalpur variety, Bombay variety, Raipur variety and Madras variety. They are graded under Quality Control and Grading Scheme of Agmark—according to colour, solidity of nuts, degree of insect attack and percentage of foreign matter—both for domestic and export marketing. Indian Standards Institution's specification (IS: 2716-1964) has been formulated for myrabolan. Agmark has developed specifications for grading crushed myrabolans.

43.2.35 Blended extracts such as *babul*-myrab, cashew--myrab and modification of myrab tannin nucleus with certain chemicals and synthetic tannins have stood the users' test as explored by the Central Leather Research Institute (CLRI), Madras. The myrab extract factory at Kolhapur, Maharashtra is already producing *babul*-myrab blended extract. Crushed myrabolans are finding increasing demand in export trade. Following table gives the composition of some of the tannin bearing materials found in quantity in India that can be used for the manufacture of blended extracts:

TABLE 43.2

Composition of Some Vegetable Tannin Bearing Minor Forest Prucodts¹

Material	Total solubles (per cent)		pH	Ratio of tan to non-tan	Type of tannin	Yield (per- cent)
	Tan	Non- tan				
<i>myrabolan</i> nuts	25—38	10—17	3.2—3.6	2.5	hydrolysable	35—40
<i>sal</i> bark	7—12	6—10	5.3—5.5	1.2	condensed	17—18
<i>karada</i> bark	20—30	8—16	4.1—5.3	2.0	Do.	35—38
<i>saja</i> bark	16—25	5—8	4.6—4.7	1.8	Do.	24—30
<i>amla</i> leaves	17—21	16—20	3.5—4.0	1.1	hydrolysable	36—37
<i>dhaura</i> leaves	12—22	11—18	4.6—4.8	1.1	Do.	30—35
<i>ghont</i> fruits	8—12	14—18	4.4—5.2	0.5	Do.	24—25
<i>babul</i> bark	9—19	9—16	4.7—5.5	1.2	mixed and/or condensed	N.A

43.2.36 A process, tried on a pilot plant scale, has been developed at the CLRI for modifying myrabolan to produce tannin extract F. An economic plant unit capable of producing 5 tonnes of tannin extract per day has been estimated to cost Rs. 22 lakhs including at least Rs. 2 lakhs foreign exchange. The cost of the extract would come to Rs. 1,500 per tonne and could be sold at Rs. 1,750.

43.2.37 We recommend that well organised factories for the manufacture of tannin extracts from all tannin yielding materials should be set up as early as possible to maximise the earnings from exports. Arrangements should be made not only to utilise the existing capacities in the crushing units, but also for setting up in a big way crushing units to manufacture more and more crushed myrabolan for export. An effective coordination must be established between the

NA — Not available.

¹ 1972. Techno-Economic Appraisal and Feasibility Report for Manufacture of Pure and Blended Tannin Extracts. Bhopal. Madhya Pradesh Audyogik Vikas Nigam Limited (Madhya Pradesh Industrial Development Corporation Limited).

national and State agencies responsible for production of raw materials, their industrial processing and export.

43.2.38 *Cutch*, a dark brown product rich in catechu tannic acid, is obtained from the heartwood of *khair* (*Acacia catechu* Willd.) *Cutch* has preservative properties and is utilised for dyeing canvass, fishing nets, mail bags and sail cloths, and also used as a boiler compound and in drilling operations. Another product obtained from *khair* heartwood in the same process is *katha*, a comparatively pale product rich in catechin. It is used in *paan* (betel leaf). Annual production of *cutch* and *katha* is 7,000–9,000 tonnes, of which about 300 tonnes are exported and the rest consumed internally. The important producing states are : Andhra Pradesh, Gujarat, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal. The potential availability according to the present resources is placed at 10,000 tonnes, while the demand in 1985 is expected to be 15,000 tonnes. There is a scope for increasing the production per unit volume of wood.

43.2.39 The yield of *katha* and *cutch* varies considerably with girth and age of trees and also the season. Maximum yields of *katha* are obtained from trees felled in autumn and winter. Trees that are gnarled and creviced are reported to give higher yields than straight ones. The yield from freshly felled trees is higher. Dead trees are unsuitable for extraction, as both yield and quality are affected by weathering. Trees which have attained a girth of 60-120 cm with visible white lines or spots in the heartwood are generally preferred for the manufacture of *katha*. Table 43.3 gives the yields of *katha* and *cutch* from heartwood in different States.

TABLE 43.3
Yields of *Katha* and *Cutch* from *Khair* wood

	<i>Katha</i>	<i>Cutch</i>
	(percentage)	
Andhra Pradesh	2	3
Maharashtra	3–4	10
	4–5*	12*
Madhya Pradesh	3	..
	1.5–1.7*	10–12*
Uttar Pradesh	4.5*	10.5*
West Bengal	6.3	..

Steps should be taken to take up a more scientific method of factory-style production to reduce wastage. It appears that the demand in the near future can be met from the available raw materials.

* Relates to factory production.

43.2.40 There are several varieties of *katha* in the market. *Katha* is priced for its catechin content which forms the main criterion for its grading. Products containing less than 18 per cent of catechin have no value as *katha* and are sold as *cutch*. The quality of *katha* in the market depends on its colour, taste and capacity to absorb water. The *katha* factory at Shivpuri is reported to be producing the following qualities :

quality	I	II	III	IV	V
capacity to absorb water (times its weight)	18	16	13	12	9

43.2.41 The economics of a 55 tonnes/year capacity *katha* factory was worked out recently (June, 1974) by the Madhya Pradesh Industrial Development Corporation Limited. It was found that a capital of about Rs. 6.0 lakhs was needed for land, buildings, and plant and machinery. The working capital needed was about Rs. 3.40 lakhs; the total capital required thus being Rs. 9.40 lakhs. While the total annual production was estimated to be about Rs. 8.64 lakhs, including depreciation and interest, the total annual receipts were estimated to be about Rs. 12 lakhs, giving a return of about 25 per cent.

43.2.42 For the establishment of factories for *katha* manufacture, availability of raw material of required specifications and in quantities within economic lead should be assured, so also its availability over a period. A survey should be taken up by the Forest Departments about the availability and regeneration of *khair*. Where necessary, a programme of *Khair* plantations should be in-built in the industrial venture, the approach being more or less the same as indicated by us in the Interim Report on Production Forestry-Man made Forests.

43.2.43 The exploitable size of *khair* trees for the manufacture of *katha* and *cutch* varies considerably in different parts of the country. In Andhra Pradesh, trees with a breast height girth (bhg) of 46 cm and above only are used. In Maharashtra, Gujarat and West Bengal the exploitable bhg is 90 cm; in most of the Forest Divisions of Madhya Pradesh 38 cm; and in Uttar Pradesh 40-60 cm. The wood containing more than 3 per cent of catechin is generally regarded as a suitable raw material for the production of *katha*. Branches having heartwood of 2.5 cm in diameter and over can be profitably utilised for *katha* manufacture. In Gujarat, 12,000 *khair* trees of 90 cm and above bhg are given to three factories annually and the production of *katha* is about 175 tonnes and *cutch* about 560 tonnes. The Rajasthan Forest Department has taken up *katha* manufacture departmentally since 1969-70, and starting from a modest production of about 30 tonnes, it is now about 150 tonnes. An economic plant would be with annual production capacity of 40 to 55 tonnes or more of *katha* per

year. Wherever requisite number of *khair* trees are available on a sustained basis, feasibility survey for establishing a *katha* factory should be taken up. It may be advisable to remove bark and sapwood in the forests and to transport heartwood only if the lead is appreciable. Feasibility for establishing ancillary plant for manufacturing tannic acid and pure catechin by solvent method should always be considered along with the feasibility study for a *katha* factory.

Gums and Resins

43.2.44 Gums and resins are exuded by plants, partly as a natural phenomenon and partly as a result of disease or injury to the bark or wood, chiefly from the stems and sometimes even from the roots, leaves or other parts. Resins are sometimes mixed with a high percentage of essential oil when they are termed oleoresins. These are important forest products widely used in food, paper and textile industries, in pharmacy, paints and varnishes, cosmetics and calico printing and as adhesives and in the preparation of linoleum, water colours and inks. Certain gums mixed with lime etc. find use in the construction industry.

43.2.45 There are several species of trees from which gum is collected and marketed in India. The most important of all the Indian gums is gum *karaya* obtained from *Sterculia urens* Roxb. and *S. villosa* Roxb., trees of the dry deciduous forests. The other important ones are: *ghatti* (from *Anogeissus latifolia*), *jhingan* (from *Lannea coromandelica* (Houtt. Merr.), *katira* (from *Cochlospermum religiosum* (Linn.), Alston. Malabar *kino* (from *Pterocarpus marsupium* Roxb.), Bengal *kino* (from *Butea monosperma*). Gum *karaya* is a very important article for pharmaceutical industries, both for industrial consumption and for export. The Chief producing States are Madhya Pradesh, Uttar Pradesh, Rajasthan and Gujarat. The present production and future requirement of some of the important gums are given in Table 43.4 :

TABLE 43.4
Present Production and Future Requirement of Some of the Important Gums (tonnes)

Name of the gum	Present production (1972)	Future requirement (1985)
<i>karaya</i>	15,000	20,000
<i>ghatti</i>	1,500	4,000
<i>babul</i>	500	1,000

Since large potential exists, future requirement can be met from indigenous sources.

43.2.46 To increase the production of gums from existing natural resources, the methods of collection have to be improved. The FRI should take up the problem and standardise methods for different localities to achieve optimum production. Stress should be laid on proper grading, so that the export is not only sustained but also increased. Future availability may be increased by creation of plantations. *Babul* can be raised in plantations in the comparatively drier tracts. Plantations of *Sterculia* spp can also be raised in dry deciduous forest areas.

43.2.47 The most important resin is that obtained from tapping the *chir* pine (*Pinus roxburghii* Sargent) and *kail* or blue pine (*P. Wallichiana* A. B. Jackson) occurring in the Himalayan forests. It is a flourishing forest industry. Rosin is one of the two important distillation products of pine resin, the other being turpentine. The States which are concerned with the production of crude resin are Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir. The total production of crude resin in the three States, together with produce therefrom is given in Table 43.5 :

TABLE 43.5
Production of Resin and its Products¹

Year	Production of crude resin (tonnes)	Output of processed product	
		Rosin (tonnes)	Turpentine (kilolitres)
1961-62 . . .	30,268	22,769	5,493
1965-66 . . .	40,028	32,261	7,867
1969-70 . . .	41,716	31,218	7,860

The stagnant output in the sixties seems to be due to the lack of demand, adequate processing facilities and diversification of products. Information received from Uttar Pradesh, Himachal Pradesh and Jammu and Kashmir since then reveals that the demand has picked up, and that improved method of collection has substantially increased the production of crude resin. The production in these States in recent years has been as follows :

		(tonnes)	
		1970-71	1973-74
Himachal Pradesh		14,390	17,290
Jammu & Kashmir		2,400	7,170
Uttar Pradesh		25,080	35,13
total		41,870	59,59

¹ Managing Director, Indian Turpentine & Rosin Co. Ltd., Bareilly—private communication.

The production in Jammu & Kashmir in 1974-75 rose to 16,670 tonnes, that is by about 135 per cent over 1973-74. If processing facilities in Government factories are augmented, products are diversified and exports are increased, the production may be stepped up to 100,000 tonnes by 1985 and 150,000 tones by 2000 A.D.

43.2.48 The Indian Turpentine & Rosin Co. Ltd., Bareilly, Uttar Pradesh was the main processing industry for a long time. At present, it is a Government-owned company. Besides this, there are three other large scale rosin and turpentine factories, all Government-owned, two in Himachal Pradesh (Nahan and Bilaspur) and one in Jammu & Kashmir (Jammu). The Jammu & Kashmir Government has planned another factory at Sunderbani in Rajouri district. In addition, there are four large-scale rosin factories and one turpentine oil based factory in the private sector in Himachal Pradesh. One more turpentine oil based factory is being installed in Himachal Pradesh. It is reported that there are several small scale resin distillation industries near Hoshiarpur in the Punjab. The installed capacities of the Government-owned factories are as follows:

	(tonnes)
Indian Turpentine and Rosin Co. Ltd., Bareilly	20,256
Government Rosin & Turpentine Factory, Nahan	3,700
Government Rosin & Turpentine Factory, Bilaspur	7,400
Government Rosin & Turpentine Factory, Jammu	2,500
total	33,856

The installed capacity of Jammu factory has been increased to 5,000 tonnes at present. The Sunderbani (Rajori) factory will have an installed capacity of 2,500 tonnes to begin with, to be increased as soon as possible to 5,000 tonnes. With all these, the installed capacity for processing in Government factories would be about 40,000 tonnes. This works out to 40 per cent of the possible production of 100,000 tonnes of crude resin by 1985.

43.2.49 The industry has a profound effect on the economy of the hill regions in the Western Himalayas. The labour payments on collection of crude resin must be touching Rs. 2.0 crores now in this region, and thousands of families earn their livelihood from it. In view of the potentiality of much higher production, employment and earnings, the resin tapping operation will be one of the most significant components in the hill economy. By directly employing villagers on piece rate, by taking up the operation largely through public cooperation and by improving the method of tapping, Jammu & Kashmir has been able to increase the yield, wages and the number employed. There has been a substantial increase in the production and

processing of crude resin in Himachal Pradesh too, and a State Forest Corporation has been set up recently to undertake the entire collection and marketing of resin and its products. The progress in Himachal Pradesh can be judged from the figures given in Appendix 43.1.

43.2.50 Apart from adopting better methods of collection, it is necessary to augment the installed capacity of the Government factories, so that a larger percentage of crude can be processed. An increase in prices has been noticed in the case of rosin export to hard currency areas. With a view to ensuring increases in export to these areas, quality of rosin must be improved, if necessary by installing modern machinery. The industry should also take up diversification of products for import substitution. One of the factories, is manufacturing estergum since July, 1970. A unit has been put up for the manufacture of rubber emulsifier in collaboration with a Japanese firm since March, 1974. Varnish and phenyle are manufactured as by-products in another factory. The production of these two by-products in 1961-62 was only about 22,000 litres. It went upto over 200,000 litres in 1969-70. The process of diversification should be introduced and enlarged in all the Government-owned factories.

Drugs, Spices and Insecticides

43.2.51 Out of about 2,000 items of drugs recorded in Indian Materia Medica, over 1,800 are of vegetable origin. About 128 of these are recognised in Indian and British Pharmacopoea. Quite a few of these are obtainable from the forests. Drugs are derived from fruits, flowers, leaves, stems or roots of trees, shrubs, creepers and herbs. They are administered as solids, liquids, infusion or dust. Of the drugs from roots, mention may be made of ipecac from *Cephaelis ipecacuanha* (Brot.) A. Rich., liquorice from *Glycyrrhiza glabra* Linn., Indian sarsaparilla obtained from *anantmul* (*Hemidesmus indicus* R. Br.), *sarpagandha* from *Rauvolfia serpentina* Benth. ex Kurz and *kuth* from *Saussurea lappa* C.B. Cl. The plant yielding ipecac is being cultivated in Darjeeling, Shillong and the Nilgiris. *Glycyrrhiza glabra* is being cultivated on an experimental scale in Himachal Pradesh and Jammu and Kashmir. The shrub yielding sarsaparilla occurs over the greater part of the country. *Rauvolfia serpentina* is a small plant growing sporadically in the sub-Himalayan tract and in the plains near the foothills, and also in the Western Ghats and elsewhere. Natural supplies have almost disappeared due to ruthless collection. It is now being cultivated. A drug is obtained from the wood of *Ephedra* sp., a small xerophytic plant found in dry places on rocks in the Himalayas above an elevation of 2,400 metres. Drugs are obtained from the leaves of

senna (*Cassia anqustifolia* Vahl) and *chiretta* (*Swertia chirata* Buch.-Ham.). *Senna* is a small plant of Southern India. Its pods are also used for drugs. *Chiretta* plant is a small erect perennial herb or shrub of the temperate Himalayas at elevations from 1,200 to 3,000 metres and of the Khasi hills.

43.2.52 Sizeable quantities of raw materials and products for vegetable drugs are imported, though India produces more than its raw material requirement in some products. For instance, it is estimated that 12 per cent of the total production of *senna* is being used in the country and the rest exported. The production of *senna* was about 5,000 tonnes in 1964-65. Since then, it has declined. In order to meet the requirement of different types of vegetable drugs, indicated below, attempts should be made to improve collection of raw material from forests, and cultivation of concerned plants in suitable localities in forest areas should be undertaken.

Name of product	Part/s used	Approximate requirement in 1985 (tonnes)
aconite	roots	203
Indian belladonna (<i>Atropa acuminata</i> Royle ex Lindley).	roots	300
<i>datura</i> (<i>Datura innoxia</i> Mill. and <i>D. metel</i> Linn.)	leaves & flowers	40
<i>Dioscorea deltoidea</i> Wall	tubers	1,500
<i>Ephedra</i>	aerial parts	75
<i>Podophyllum</i>	rhizomes & roots	150
<i>sarpagandha</i>	roots	1,600
<i>nux-vomica</i>	seeds	2,000
<i>ipecac</i>	roots	50
Indian squil (<i>Urginea indica</i> Kunth)	bulbs	50

The organisation for MFP that we have suggested in Section 4 should review from time to time the requirement of vegetable drugs that may be produced from forest raw materials, and explore the possibilities of their cultivation in forest areas. The overall responsibility for research and organisation for medicinal plants would be the same as for essential oils discussed in paragraph 43.2.10.

43.2.53 A large number of spices are obtainable from forests. *Kala jira*, seeds of *Carum carvi* Linn., is a much valued spice because of its strong agreeable flavour. It is also a stomachic, carminative and lactagogue. The species occurs naturally in certain temperate forests and is also cultivated at altitudes from 2,700 to 3,600 metres. Galanga is obtained from *Alpinia galanga* willd., a plant found in the Eastern

Himalayas and in the Western Ghats. It has perennial rhizomes which are aromatic and pungent. Cinnamon or *dalchini* is the bark of *Cinnamomum zeylanicum* Blume, a tree of the Western Ghats from Konkani southwards found upto an elevation to 1,800 metres. It is astringent, stimulant and carminative, also used in candy, gums, incense, detritrice and perfumes. It has a delicate fragrance and sweet agreeable taste. Indigenous production is insufficient. *Elaichi-chhoti* or lesser cardamom are the dried capsules of *Ellettaria cardamomum* Maton, a small plant growing wild in the evergreen forests of South India. The seeds are used as a masticatory, as a flavouring for sweet dishes and as a Carminative. *Elaichi-badi* or greater cardamom are the pods of *Amomum subulatum* Roxb. growing in Sikkim and Kalimpong forests in the Eastern Himalayas. It is an inferior substitute for the former.

43.2.54 Another spice of tree origin that may be mentioned here is *tejpat*, the leaves of *Cinnamomum tamala* Nees & Eberm. It is used for flavouring curries, and consumed both indigenously and abroad. The tree grows in the evergreen and semi-evergreen forests of North-Eastern Region, generally at an elevation of about 1,000 m. It may not be possible as yet to cultivate the species, as little is known about its regeneration. Research may be taken up to find out how the production of *tejpat* could be developed. In the meantime steps should be taken to survey and map the occurrence of the species and to take up methodical collection of leaves and their curing.

43.2.55 An important insecticide is obtained from pyrethrum (*chrysanthemum cinerææfolium* vis.). It is being cultivated in Jammu & Kashmir and in the Nilgiris in Tamil Nadu on a limited scale. Pyrethrum plantations were raised after the World War II to a very large extent on the Nilgiris and the Palnis, plains of Karnataka, Jammu & Kashmir and West Almora in Uttar Pradesh. But due to synthetic insecticides like DDT flooding the market there was no demand and the plantations were given up. The flower heads of the species yield pyrethrum of commerce. Pyrethrum owes its importance, compared to many other natural and synthetic insecticides, to its non-toxicity towards warm blooded animals when ingested and high toxicity to insects even on contact. Though its use has become limited due to development of a number of synthetic insecticidal chemicals, it is still used in substantial quantities. The use of DDT and other synthetic chemicals as insecticides has aroused great alarm as they are reported to be highly toxic to human beings. In fact, in certain countries the use of DDT has been prohibited. This has revived the demand for pyrethrum again. A study should be undertaken by the all-India organisation responsible for the development of medicinal

plants regarding the future demand of pyrethrum in the country. Increase in the production of pyrethrum may be planned accordingly. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Meghalaya, Karnataka and Tamil Nadu are the States where there are promising possibilities of raising pyrethrum plantations.

Leaves

43.2.56 The most important from the commercial point of view are the leaves of *tendu* (*Diospyros melanoxylon* Roxb.), used as wrappers of tobacco to produce *bidi*. It is a medium sized tree found throughout the dry forests of the plains, chiefly in Madhya Pradesh and Orissa, and to a lesser extent in Andhra Pradesh, Bihar, West Bengal, Maharashtra, Tamil Nadu, Gujarat, Rajasthan and Southern Uttar Pradesh. In certain parts of the country, leaves of *apta* or *ashitri* (*Bauhinia racemosa* Lam.) are also used as wrappers in the manufacture of *bidi*.

43.2.57 The annual collection of *tendu* leaves in the country is estimated to exceed 300,000 tonnes, of which about 45 per cent come from Madhya Pradesh alone. The annual collection in Orissa and Maharashtra has been estimated at 50,000 tonnes each and in Andhra Pradesh at around 40,000 tonnes. The remaining production is shared by Bihar, Gujarat, Rajasthan, Uttar Pradesh and West Bengal, Bihar and Uttar Pradesh being relatively more important. Coppice shoots and root suckers of the tree produce good quality leaves and for this purpose, pollarding and pruning are practised in certain parts of the country. Pollarding/pruning is usually undertaken during the month of February/March and plucking usually starts about the middle of April and continues upto the end of May, extending sometimes upto the first/second week of June. With the onset of rains, collection of leaves stops because of difficulty in drying. Utilisation of *tendu* leaves is spread all over the country throughout the year. There are no assembling markets as such for *tendu* leaves, and the important villages and towns in producing areas, where facilities for storage and transportation are available, usually serve as assembling centres. Madhya Pradesh, Maharashtra, Rajasthan, Orissa, Andhra Pradesh and Uttar Pradesh Governments have nationalised the trade in *tendu* leaves. It is the experience of all the States that the nationalisation not only brought extra revenue to the States, but also ensured payment of reasonable minimum wages to the collectors.

43.2.58 As is the case with the production of *tendu* leaves, so also utilisation is maximum in Madhya Pradesh and, therefore, this State is the most important *bidi* producing State in India. It is esti-

mated that nearly 70 per cent of the *tendu* leaves collected are used within the State itself. The remaining quantity is despatched mainly to West Bengal, Maharashtra, Karnataka and Uttar Pradesh. In Maharashtra, 65 to 70 per cent of the *tendu* leaves produced is used within the State. The rest is sent to Karnataka, Kerala and Tamil Nadu. A substantial quantity of best quality leaves obtained in Orissa is exported to other countries. The remaining quantity is utilised within the country, mainly in West Bengal and Maharashtra. Andhra Pradesh caters to about 60 to 70 per cent of the requirement of Kerala.

43.2.59 Reasonably dependable statistics are being kept by the Madhya Pradesh Forest Department since the *tendu* trade has been nationalised. The production of *tendu* leaves in Madhya Pradesh from 1971 to 1973 is given below¹:

	(tonnes)
1971	80,880
1972	89,820
1973	96,090
1974	96,840

It was estimated by the Indian Institute of Foreign Trade that hardly 1-2 per cent of collection is exported. There is scope for increasing the production of good quality *bidi* leaves and avoiding wastage by improving the methods of collection, transport, grading and storage.

43.2.60 The Government of India had prescribed grade standards for *tendu* leaves and notified the *tendu* (Bidi Wrapper) Leaf Grading and Marking Rules, 1963, under the provisions of the Agricultural Produce (Grading and Marking) Act, 1937. The Government of India also took recourse to the Indian Customs Act, 1962 and prohibited with effect from August 15, 1965 export of *tendu* leaves unless the same were graded and marked in accordance with the prescribed standards. The grade specifications are based on colour, texture, size, shape, body and condition of the leaves and seven grades have been prescribed for the purpose, viz. Fancy, Extra special, Special, Good, Standard, Fair and General. Grading of *tendu* leaves is beneficial to both the sellers and the manufacturers of bidis, but no proper attention is paid towards sorting and grading of *tendu* leaves in general. Therefore, grading of *tendu* leaves as per *agmark* standards should be gradually extended to leaves which are consumed by the domestic industry. The Governments of the States, where there is already state control over collection and disposal of *tendu* leaves, should enforce grading of *tendu* leaves prior to sale.

¹ Chief Conservator of Forests, Madhya Pradesh—private communication.

43.2.61 There is an urgent need to initiate research to correlate yield and quality of *tendu* leaves in relation to pruning, pollarding of trees and other related operations. Control of pests and diseases, rotational working, regeneration, and a host of such problems remain to be tackled. In our Interim Report on Forest Research and Education, we recommended establishment of fully equipped research institutes in the States, in addition to the setting up of regional research institutes and centres by the Government of India. We recommend that these institutes/centres should take up research on all aspects of *tendu* leaves production, quality and grading, etc. Concerned agricultural universities should also be associated with such research.

Edible Products

43.2.62 Several forest fruits, flowers and even leaves and tubers or roots are eaten. Honey is a very important product obtained from forests in many parts of the country. In Chapter 27 on Apiculture, we have discussed the association of forests in the production of honey. We have stated that in order to encourage multiplication of bee colonies in Nature, natural flora will have to be developed all-round. We have recommended that a survey of vegetation of forests and other areas with regard to floristic composition should be undertaken. Preparation of floral calendar giving flowering seasons and duration for different regions is required. We have also stated that insofar as research pertaining to forest vegetations are concerned, it would be profitable to associate the FRI. The FRI could indicate specifically which type of vegetation is worthy of introduction in different types of forests including the lands which are going to be put under social forestry.

Lac and its Products

43.2.63 Lac is the resinous protective secretion of the tiny lac insect (genus *Laccifer*, family Lacciferidae, order Hemiptera). The commonest and the most widely occurring species of lac insect in India is *Laccifer lacca* Kerr. The minute red coloured larvae of the insect settle on young succulent shoots of the host plants in myriads. The secretions from individual insects coalesce and form a hard continuous encrustation over the twigs. After the completion of the life cycle and just about the time the adults of the next generation begin to emerge, the resinous encrustation is scraped from the twigs and branches of host trees, giving what is called sticklac. The removal of insect bodies, twigs, lacye and dirt from the sticklac gives

commercial seedlac. Shellac is obtained by either melting or by extracting the resins by solvents from seedlac. Lac finds a wide variety of application in plastics, electricals adhesives, leather and wood finishing, printing ink and other industries. It is also the principal ingredient of sealing wax. Its main use at one time was in the manufacture of gramophone records, which declined recently due to the introduction of synthetic materials.

43.2.64 Lac cultivation is done by about three million *adivasi* (tribal) cultivators. It is primarily grown in Chota Nagpur and Santhal Parganas of Bihar, Purulia and Bankura districts of West Bengal, eastern parts of Madhya Pradesh and Uttar Pradesh, Bhandara and Chanda districts of Maharashtra, and Koenjhar, Mayurbhanj and Sundergarh districts of Orissa. The average annual production in the fifties and sixties are given in the Table 43.6 :

TABLE 43.6
Average Annual Production of Sticklac in Different States^{1, 2} (tonnes)

Name of the State	Average for 1951—60	Average for 1961-62 to 1965-66	Average for 1966-67 to 1970-71
Bihar	17,341(41.8)	13,334(44.4)	17,185(57.9)*
Madhya Pradesh	13,019(31.4)	6,818(22.7)	6,099(20.6)
West Bengal	6,580(15.9)	3,948(13.1)	2,754(9.3)
Uttar Pradesh	657(1.6)	1,723(5.8)	1,955(6.6)
Other States	3,889(9.3)	4,194(14.0)	1,676(5.6)
Total	41,486	30,017	29,669

43.2.65 India held a virtual monopoly of lac, and till about 1950, accounted for nearly 85 per cent of the world's production of sticklac. Since 1950, however, lac production in Thailand has increased appreciably and it now supplies 25 to 30 per cent of the world's requirements. The position relating to the production of sticklac in India during 1970-71 to 1973-74 is given below³:

	(tonnes)
1970-71	24,560
1971-72	27,211
1972-73	17,038
1973-74	19,258

¹ 1972. Indian Forest Utilisation, Vol. II : Table XXVI 3. Delhi Manager, of Publications. Government of India.

² 1972. Export Potential Survey—Madhya Pradesh, Vol II. New Delhi. Marketing Research Division, Indian Institute of Foreign Trade.

* Figures in brackets are percentages of the total.

³ Directorate of Lac Development, Ranchi—private communication.

The prices of lac have been ruling at consistently high levels from the year 1971-72 onwards, and 1973-74 prices were the highest so far. But adverse weather conditions during the years 1970-71 and 1971-72 not only resulted in low production but also in severe brood shortage for the year 1972-73. Accordingly, the production in 1972-73 touched the bottom. It is expected that in 1974-75 the production of stick-lac may be between 21,000 and 25,000 tonnes. Since the price of lac is ruling quite high and an increase in demand has been noticed, it is possible to minimise the wide fluctuations in production experienced in the past by taking the necessary corrective steps. Success in lac production depends on the proper application of the knowledge gained in the pest-host relationship, viz. the life-cycle of the lac insect as related to the silvicultural management of host plants, on which it thrives. Considerable advance has been made in the knowledge of this relationship, particularly as a result of investigations conducted at the Lac Research Institute at Namkum, Bihar.

43.2.66 Two strains of the lac insect are commonly recognised in India, the *rangeeni* and *kusumi*; lac crops raised from them are named after the months in which they are harvested. Corresponding to the life-cycle of the lac insect, there are two crops each in a year in the two strains of lac. *Kusumi* produces *aghani* in January-February from plants infected in June-July, and another crop *jethwi* obtained in June-July from January-February infection. *Rangeeni* strain produces *katki* crop harvested in October-November from the inoculations made in June-July and *baisakhi* obtained in June-July from inoculations in October-November. In Karnataka, *rangeeni* strain is found to complete three life-cycles in 13 months on the host *jallari* (*Shorea talura* Roxb.), due to climatic difference, though the same Karnataka strain when grown on *jallari* in Northern India has only two life-cycles in a year. Eighty to ninety per cent of the country's production is from *rangeeni* crops.

43.2.67 The selection of host trees is of the greatest importance as on this the quality and yield of lac largely depend. The trees should be fairly quick-growing adaptable to pollarding and able to withstand heavy infestation of the lac insect. There are well over one hundred species of plants on which the lac insect has been recorded. The major hosts are : *palas* or *dhak* and *ber* (*ziziphus* spp) in the case of *rangeeni* strain, and *kusum* in the case of *kusumi* strain. Bulk of the lac production is from the above hosts. There are several other hosts of specific importance. For instance, *khair* is a very good host plant for growing the *katki* or *aghani* crop in alternation with the normal *rangeeni* or *kusumi* hosts. Several *Ficus* species are used for growing the *baisakhi* crop which attains maturity with comparatively much less mortality, but these trees are used more for the sake of preserving

broodlac than for raising lac as a commercial crop. There are several host plants of local importance too, although some of these species may have very wide occurrence like *babul*. *Arhar* (*Cajanus cajan* (Linn.) Millsp.) is classed as a major host. It will be observed that the occurrence of the lac insect is not confined to a single genus, or to a single family, or even to a group of closely related families as is the case with most insects. The factor that determines whether the lac insect will flourish on a particular species or not is the character of the sap of the host plant. It is now believed that the sap reactions of good lac host should be near about neutral or slightly acid (e.g. pH values between 5.8 and 6.0) and that the sap density of good lac host plants is generally lower than that of others.

43.2.68 The proper management of the host plants, use of pest-free brood, time and manner of inoculating host plants and control of pests and predators of the lac insect are all important for ensuring good yields of lac. Research and experiments in this regard have established suitable measures to be taken with respect to the following:

- (i) pruning,
- (ii) time of collection of broodlac,
- (iii) selection and use of broodlac.
- (iv) artificial and natural infection,
- (v) precautions against predators and parasites,
- (vi) systematic cultivation,
- (vii) preservation of broodlac, and
- (viii) alternation of host.

Measures to be taken in these respects for the success in production of sticklac are available in published literature¹.

43.2.69 The marketing arrangements of lac at present are still primitive. The cultivator harvests the lac crop and brings it in head-loads to the nearest village market, which is the primary market. An intermediary buys the lac and sends it to either a manufacturer or another agent in the secondary market. The manufacturer then despatches it either directly to the export market or to a manufacturer-cum-exporter, a merchant exporter, or even another intermediary. The transactions may pass through many intermediaries before the product is finally despatched to the export market.

43.2.70 The processed products from the raw material 'sticklac' are generally classed into five categories: seedlac, shellac—handmade, shellac-machine-made, button and garnet lac, and other lacs. Bleached lac is a refined product obtained by chemical treatment. It is prepared by dissolving shellac or seedlac in sodium carbonate solu-

¹ 1972. Indian Forest Utilisation, Vol. II : pp. 810-816. Delhi Manager of Publications, Government of India.

tion, bleaching the solution with sodium hypochlorite, and precipitating the resun with sulphuric acid. Bleached lac deteriorates quickly and should be used within 2-3 months of manufacture. The fate of the industry is linked with export trade, as the internal consumption is only 10 per cent of the total production. Though Bihar is the largest producer of basic raw material, the main industrial products, i.e. machine-made and hand-made shellac, are mostly the output of industries based in West Bengal. Of late, lac is being used mainly in the form of bleached lac in UK, USA and Federal Republic of Germany.

43.2.71 We are of the view that cultivation, processing and marketing should be considered as an integral industrial venture. The activities concerning lac cultivation and processing should be taken up as parts of both drought prone areas programme and tribal development programme. It is necessary that vigorous steps are taken to minimise the wide fluctuations in production experienced in the past by taking necessary corrective steps.

43.2.72 All possible efforts should be made to increase the production by : (a) assessing the requirement of broodlac by the needy cultivators and arranging for its supply; (b) taking suitable 'extension' measures in order that the cultivators adopt the correct methods of pruning, inoculation, harvesting, broodlac preservation, pest control, etc; (c) persuading the cultivators to grow idle lac hosts for which necessary steps should be taken under social forestry programmes; and (d) arranging suitable demonstrations. The Forest Department concerned should take suitable steps in the preservation, allocation and maintenance of suitable host trees. A minimum remunerative price to the primary producers should also be guaranteed. Whenever export prices shoot up, the comparable advantage should be passed on to the primary producers. By this arrangement, it may be possible to maintain a production level of 30,000 tonnes of sticklac by 1985 and then gradually increase it to 50,000 tonnes by 2000 AD.

43.2.73 Arrangements for marketing and storage of the primary products, namely sticklac and seedlac, should be streamlined. It may be possible to link up this arrangement with the State MFP organisation or cultivators' cooperative societies. For the success of these arrangements, it may be necessary link up this institutional arrangement with manufacturers of shellac and exporters.

43.2.74 In Chapter 12 on Export possibilities and Import Substitution, we have suggested two alternative arrangements, either in the form of a Commodity Board or an Inter-Ministerial Action Group, for coordinating the activities of various organisations handling lac and its products. The Board may be empowered to pur-

chase all sticklac from cultivators/collectors at pre-determined prices and sell it by auction to the manufacturing units for processing and export. Alternatively, the Lac Development Directorate and the Indian Lac Research Institute may be brought together, so that these organisations and the Shellac Export Promotion Council could be responsible to a single authority, like the Inter-Ministerial Action Group. We have also recommended that the capacity of the lac bleaching industry should be developed.

43.2.75 As regards research, the Lac Research Institute at Namkum is currently undertaking a large volume of research on all the aspects of lac cultivation and processing. The selection and management of lac hosts are receiving attention. Research for finding out new host plants should be intensified. It is reported that rain tree (*Samanea saman* (Jacq.) Merr.) and *putri* (*Croton oblongifolius* Roxb.) were able to carry lac insects till maturity in both *rangeeni* and *kusumi* strains. Among the bush hosts, *bara salpan* (*Moghania chappar* (Ham. ex Bth.) O. Kz.) was tried for *jethwi* crop in 1974, but the crop was heavily attacked by chalcids resulting in a very poor crop. Effective control of lac predators, improvements in broodlac preservation, etc. are other aspects requiring immediate research efforts. The presence of dye in lac resin is a serious drawback necessitating bleaching, which not only involves considerable expenditure but also destroys some of the desirable properties of lac. A lac insect producing white lac has been very recently discovered, but the biological and economical performance of the mutant lac insect should be studied further before a judgment can be passed on it. It had been reported that biological control of predators of lac insects has not been a success due to smallness in number of the parasites of predators. More stress should be laid on evolving integrated control of enemies of lac insects.

43.2.76 Much work requires to be done for effecting improvements in the processing techniques, particularly with reference to the use of efficient, and at the same time economic, solvent. Another important direction of research in this regard would be to discover technique for replacing synthetics with shellac for making heat-and water-proof laminates. Shellac modified with melamine resin has been tried. But the resultant boards did not come up to the standard expected in the market.

Destructive Distillation of Wood

43.2.77 The important products of wood distillation are : charcoal, upto 33 per cent; wood tar, 7 to 11 per cent; acetic acid, 5 per cent and methyl alcohol with acetone about 2 per cent. Of these,

charcoal is chiefly used as domestic fuel and also in industrial fields for reducing metal oxides in blast furnaces and for the manufacture of chemicals like carbon bisulphide, sodium cyanide, carbon tetrachloride, etc. Methyl alcohol is mostly used as a solvent in shellac varnishes and lacquers and also in the manufacture of formaldehyde which in turn is used for the manufacture of synthetic resins, plastics, etc. Acetic acid is used in making inorganic acetates, pigments, lacquers, etc. Tar and tar oils are used in paints, disinfectants, creosote preservatives, etc.

43.2.78 In India there is hardly any industry undertaking the distillation of wood as a commercial activity. The Iron and Steel Works, Bhadravati in Karnataka undertook sometime ago wood distillation on a commercial scale, but it has been discontinued probably due to uneconomic production. Small scale units exist in large numbers for the production of charcoal, but no attempts to recover by-products are made. It is possible that wood distillation may become economic again, particularly in view of the fact that it can produce formaldehyde used in the manufacture of synthetic resin for use in the panel industry. At present the most widely used adhesive in the panel industry is the phenolic resin derived from oil. The price of synthetic resin in this country has always been much higher than the international price. Due to increase in the price of oil, the cost of adhesive has increased, and the effect is likely to be that the panels of Indian manufacture would be non-competitive in the export market. As such we recommend that an attempt should be made to take up wood distillation commercially after making a thorough feasibility study, specially in areas from where extraction of fuelwood is uneconomical, e.g. in North Eastern India, Bastar in Madhya Pradesh, etc. Research on wood distillation and development of machinery should be intensified at the FRI and also regional research laboratories of the Council of Scientific and Industrial Research (CSIR).

Plantation Crops

43.2.79 Sporadic efforts have been made to cultivate a few plantation crops, like rubber, cashew, coffee, etc., in certain forest areas. For instance, the para rubber tree (*Heavea brasiliensis* (H.B.K.) Muell.-Arg.) is planted on forest lands in several States. The plantations raised from 1961-62 to 1971-72 by the Forest Departments of Karnataka, Kerala and Tamil Nadu were to the extent noted below¹:

¹ Central Forestry Commission and Chief Conservator of Forests, Karnataka—private communications.

	(hectares)			
	Karnataka	Kerala	Tamil Nadu	Total
Third Plan(1961—66) .	318	30.5	1,190.0	1,528.5
Annual Plans(1966—69)	1,388	18.6	530.8	1,937.4
Fourth Plan :				
1969-70 . . .	1,088	6.2	189.1	1,283.3
1970-71 . . .	1,130	6.2	100.8	1,237.0
1971-72 . . .	150	4.4	171.8	336.2
Total . . .	4,074	65.9	2,182.5	6,322.4

The Forest Department of Goa has recently undertaken rubber plantation. Another plantation crop to be raised by the Andaman & Nicobar Forest Department is the red oil palm (*Elaeis quineensis* Jacq.), an important oilseed yielding tree. There is a proposal to raise 2,400 ha of red oil palm plantation in the Little Andaman Islands. The site for the plantation has been selected and action for importing the first instalment of seeds is in progress. The project in Andaman & Nicobar Islands is a part of the scheme of the rehabilitation of refugees and repatriates; many of them had been plantation labourers in Sri Lanka or elsewhere. We have discussed rubber and red oil palm in some detail in Chapter 24 on Plantation Crops.

43.2.80 In Chapter 41 on Forest Policy, we have recommended in paragraph 41.5.18 that possibilities should be explored for cultivating plantation crops, like rubber, coffee, cashew, etc., in suitable localities on forest lands to the extent that it does not interfere with the production of industrial wood. The MFP organisations in the States, particularly in Kerala, Tamil Nadu, Karnataka and Goa, should keep this recommendations in view.

3 EXPORT

43.3.1 We have grouped the MFP, as follows, in discussing their exports :

- (i) plants for use in dyeing and tanning ;
- (ii) natural gums, resins and balsams ;
- (iii) lac and its products ;
- (iv) vegetable materials used for plaiting etc. ;
- (v) plants and seeds used in pharmacy and perfumery ;
- (vi) bidi leaves ; and
- (vii) essential oils.

In Appendices 43.2 and 43.3 we have given the values and quantities respectively of exports of the above groups of MFP. The statistics for

some of the more important items in each group have been given separately in the Appendices.

43.3.2 It is seen from the Appendices that not only are the items traditional, but so also are the markets. Western Europe and North America remain the most important regions for the export of MFP from India. This is hardly surprising, because the produce is all raw material for which even intermediate processing facilities are inadequate in this country. Except for Western Europe, the traded quantity has fluctuated between 1967-68 and 1971-72, and 1972-73 was definitely a bad year for MFP exports. The average unit value has, however, risen steadily, except in 1972-73, in respect of MFP exports to Western Europe and North America.

43.3.3 It can be said that while considering the traditional items of MFP for export, greater attention should be paid to the identified traditional markets for each kind of produce, in order to ensure a secular growth of export. For this, it would be necessary not only to increase production and collection, but also to have market intelligence abroad and quality control at home. In Section 2, we have referred to the existing system of grading with respect to myrabolans and *tendu* leaves. *Agmark* standards for all important items of MFP should be developed and enforced to ensure confidence in Indian products. A pre-shipment inspection by the national export organisation should be made compulsory.

Plants for Use in Dyeing and Tanning

43.3.4 The export under this group varied widely in the last few years, and there was a sharp drop in 1972-73, as the Appendices 43.2 and 43.3 show. Of the various articles in this group, myrabolan is the most important MFP in addition to export in whole or crushed form, myrabolan fruit extracts are exported. The quantity and value of the export of myrabolan to different economic regions for the years 1969-70 to 1973-74 are given in Appendix 43.4.

43.3.5 The Appendix 43.4 includes three articles—myrabolans, *amlā*; myrabolan, other (mainly chebulic); and myrabolan fruit extract. The export of these commodities has shown wide fluctuations. Though there is some recovery in 1973-74, it is still half of what was exported in 1969-70, but the unit value has risen. It has been indicated in paragraph 43.2.34 in Section 2 that there was a sudden peak in collection of chebulic myrabolan in 1971-72 in Madhya Pradesh and a drop afterwards. The appendix also shows 1972-73 to be quite a dismal year for export of myrabolan. Almost 10 per cent of the export takes place to the UK, and the volume of export is thus sensitive

to the demand in the UK market. The major buyers in the countries of the ESCAP* Region are Afghanistan, Sri Lanka, Hong Kong, Singapore, Thailand and Japan.

43.3.6 The decline in export of crude myrabolan may be partly ascribed to lack of proper grading, and partly due to the increase in the export of tanned leather, apart from the fluctuations in the demand in the UK market. If the production of tanning extracts can be augmented substantially and export of tanned leather increased, it is not necessary to aim at a high quantity of crude myrabolan export. The export strategy with regard to this item may be geared to the UK market, where the demand of crushed myrabolan may be around 10,000 tonnes by 1985. Considering that India should be able to continue exports to other countries also, we are of the opinion that target for export should be aimed at 10,000 tonnes in 1985 and 20,000 tonnes in 2000 AD — all in crushed form.

Natural Gums, Resins and Balsams

43.3.7 About twenty per cent of India's average export earnings from MFP during the years 1971-72 to 1973-74 has been contributed by this group of products. Gum *karaya* was the biggest single item of export in this group, contributing to about 70 per cent of the export earnings. Nearly 50 per cent of the exported quantity of gum *karaya* went to USA, with another 30-33 per cent to Western Europe. Region-wise trade in gum *karaya* from 1969-70 to 1973-74 is given in Appendix 43.5. The total export over the years was about 4,500 — 5,500 tonnes per year.

43.3.8 The export of gum *karaya*, both in quantity and value, has reached a plateau, and future growth of exports is quite uncertain. This should cause concern and needs a probe. We recommend that an organisation at an all-India level for export promotion and the State MFP organisations† should undertake a study of the problems of increasing export of gum *karaya* by contacting established exporters, particularly in gum *karaya*, and also by collecting export intelligence from the markets of USA, UK and France, in order that corrective steps can be taken. The export earnings can be substantially increased, if tapping of gum *karaya* is done on scientific lines. The Madhya Pradesh Forest Department has prescribed on the basis of research, scientific tapping methods in its forest working plans. It would be necessary to extend these tapping methods to other States. The FRI should collect the information and pass on the same to all the States.

* Economic and Social Commission for Asia and the Pacific.

† See section 4.

Lac and its Products

43.3.9 During the period 1971-72 to 1972-73, about one-third of the total average earnings from export of MFP came from lac and its products. The gradual drop in quantity exported from 1969-70 onwards and then a sharp drop in 1972-73 which continued in 1973-74 merits a very careful scrutiny. The shortfall in the quantity of export was not due to any sudden shrinkage of overseas demand, but was largely due to the shortage of production.

43.3.10 An encouraging feature is the accelerated trend of rise in unit prices in the export market as illustrated in Table 43.7, though the quantity exported has come down considerably.

TABLE 43.7
Export Value of Lac and its products
(yearly average—Rs. per kg.)*

Category	1969-70	1970-71	1971-72	1972-73	1973-74
seedlac	2.01	2.70	3.64	7.63	19.51
shellac (hand-made) .	2.87	3.72	4.69	7.96	24.38
shellac (machine-made) .	3.50	4.54	5.58	8.71	25.47
button and garnet lac .	2.51	3.27	4.15	7.29	21.23
other lacs	1.04	1.32	2.78	4.06	8.50
total average .	2.85	3.74	4.80	8.18	25.6

It is seen that the prices fetched have increased quite rapidly over the years, and there is no reason why cultivators/collectors cannot reap the benefit. The fact, however, is that they did not, contributing to a decline in output.

43.3.11 Since lac is used mainly in spirit varnish and french polish, export has suffered due to increased substitution of wooden furniture by those made of laminate, steel, aluminium and plastic. In the case of special shellac, dewaxed and bleached shellac, there is severe competition from West Germany particularly in the Latin American market. Regarding hand-made and machine-made shellac, USA, West Germany and Japan prefer hand-made, as they have their own sophisticated processing units. USSR and other East European countries are emerging as potential buyers of machine-made shellac. The steep decline in seedlac export is partly due to intensive competition from Thailand. Furthermore, European Common Market

* Compiled from Appendices 43.2 and 43.3.

(EEC) countries and Japan have declined to extend tariff concessions for lac and its products under a Generalised System of Preferences.

43.3.12 Appendix 43.6, Statements I to IV, gives the regionwise export figures for lac and its products. The detailed statistics show that UK and USA are significant markets for all the categories, while West Germany and Netherlands are the largest buyers for seedlac. USSR, Brazil, Australia, Singapore, Phillippines and the EEC countries are the important markets for machine-made shellac, while USSR and the EEC countries are large buyers of hand-made shellac.

43.3.13 Export of machine-made shellac and other processed products gives the country a greater economic advantage. More concentrated efforts should be made to develop the widely varied markets for the export of these items, and to gear their production, quality control, etc. For promoting the production and export earnings from this source, it would be desirable to have a stable and continuing production base. For this purpose, steps as indicated in paragraph 43.2.72 to 43.2.74 should be taken. Potential export can be placed at 20,000 tonnes in 1985 and 40,000 tonnes by 2000 AD.

Vegetable Materials used for Plaiting, etc.

43.3.14 The items exported under this group are bamboo and cane. Bamboo is exported either whole, when it can also be used for constructional purposes, or split for use for plaiting. The total value of exports was negligible, and contributed approximately to one-half of one per cent of the values of all MFP exports during the period 1971-72 to 1973-74. The main market during the period was Bangladesh. However, in view of the fact that India needs to utilise all its bamboo resources for industrial as well as household purposes, we do not visualise any significant export under this group.

Plants and Seeds used in Pharmacy and Perfumery

43.3.15 This group had contributed 25 to 30 per cent of total foreign exchange earnings from MFP during the period 1971-72 to 1973-74. There are twelve important individual items of MFP available from forest areas which are recognised in the export statistics. These are: (a) agarwood in chips, (b) belladonna leaves and roots, (c) *chirata*, (d) *galangal* rhizomes, (e) *kuth* root, (f) nux-vomica dried ripe seed, (g) psyllium husk, (h) psyllium seed, (i) sandalwood chips and dust, (j) *senna* leaves and pods, (k) *tukmaria*, and (l) zedovary roots. Of the above, the most important, both in quantity and value, are psyllium husk and seed, sandalwood chips and dust, *senna* leaves and pods, and *kuth*.

43.3.16 From the data given in Appendices 43.2 and 43.3, it is seen that psyllium husk and *senna* leaves and pods contributed about 85 per cent of the exports in terms of value in this group, and these two items may be considered as the traditional items of export. There has been a sharp increase in the unit price of these two items in 1973-74. In Appendix 43.7 is given the regionwise trade in psyllium husk. Analysing the detailed statistics of export, we find that more than 80 per cent of psyllium husk was exported to USA, about 16 per cent or so to the EEC countries, with Afghanistan taking about 3 per cent. In the case of *senna* leaves and pods, the EEC countries (West Germany was by far the biggest purchaser) imported about 52-55 per cent of this product exported from India, and the East European countries (notably Hungary) about 35 per cent. The other significant markets for this product were Japan, USA and Argentina. Attention should be paid to these identified significant markets.

Bidi Leaves

43.3.17 The main markets for *bidi* leaves are Sri Lanka, Nepal and Bangladesh. The quantity exported, however, is only a small fraction of total production. Annual collection of *bidi* leaves is about 3 lakh tonnes, but only about 4,000 tonnes are exported. It has, however, a very high unit value and the chances of large scale smuggling cannot be discounted. Therefore, there is all the more reason that the export of this product should be channelised through a national export organisation for forest product, the setting up of which we have recommended in the next section. Of late, there is a tendency towards a decline in official export, but one of the reasons may be smuggling. It is also found that after a constant rise, the prices have shown slight decline in 1973-74. We expect that the volume of export would be maintained at a level of 4,500 tonnes. At current prices, the value would be between Rs. 1.00 and Rs. 1.25 crores.

43.3.18 It may be mentioned that manufactured *bidis* have a much wider market — in Malaysia, Singapore, Afghanistan, West Asia and even in some West European countries, like Switzerland, Netherlands and UK. The manufacture of *bidis* would make for a better employment situation in cottage scale industries. The unit price of manufactured *bidi* has also been found to rise steadily.

Essential Oils

43.3.19 In the Appendices 43.2 and 43.3, we have given the statistics of exports of the following items separately: (a) eucalyptus oil,

(b) lemon grass oil, (c) palmarosa oil, (d) sandalwood oil and (e) *khus* or vetiver oil. There were some fluctuations in the total quantity exported between 1969-70 and 1971-72. During 1972-73 and 1973-74 these items fared well in the export market and the quantity exported came to over 500 tonnes. Individually lemon grass oil and eucalyptus oil have come up very well, though sandalwood oil continued to be the principal exchange earner in this group. Regionwise export of sandalwood oil is reproduced in Appendix 43.8. The important markets are in Eastern and Western Europe, ESCAP countries and North America.

43.3.20 Regarding unit value of the produce, the price of sandalwood oil has risen considerably in the last two years, after remaining practically stable during 1969-70 to 1971-72. The price of lemon grass oil has also increased somewhat. But the most remarkable is the jump in the price of eucalyptus oil in the export market in 1973-74. Since *Eucalyptus globulus*, *E. citriodora* and some other eucalyptus, that are being grown in many parts of the country on a fairly large scale, are likely to yield marketable oil there is good scope for increasing eucalyptus oil export. Simultaneously, efforts should be made to increase production of sandalwood oil and lemon grass oil with a view to increasing export in identified markets. Oils similar to sandalwood oil are produced in South East Asia (Singapore) and Australia. The Australian oil is important commercially and is obtained from the tree *Eucarya spicata* Sprag. & Summ. syn. *Santalum spicatum* DC., which is found in Western Australia. The oil is regarded as a typical sandalwood oil and its characteristics are very similar to the Indian oil. Singapore has recently been making serious attempts to capture a larger share of the market, and the oil produced in that country is of good quality. While promoting export of sandalwood oil, it should be borne in mind that there is likely to be a serious challenge from these countries.

43.3.21 Recently it is noticed that the demand for sandalwood oil has slumped considerably in the export market. It may not be so much due to the substitution mentioned in the previous paragraph by other natural oils, but it is likely that non-availability of sandalwood oil, when needed, forced perfumers to switch on to synthetics. The price of sandalwood obtained in auctions held by the Forest Departments is entirely dependent on the export market. Prices started rising from 1972 and they shot up all of a sudden to an average of over Rs. 50,000 per tonne in July 1974 auction sales in some sale depots in Tamil Nadu, as shown below :

		(Rs./tonne)
	Tirupattur sale depot	Sathyamangalam sale depot
July, 1972	8,751	9,997
December, 1972	9,940	10,484
July, 1973	14,310	14,877
December, 1973	25,429	26,484
July, 1974	51,463	50,030

In July 1974 the price of sandalwood oil in the export market was around US \$ 200 per kg. Immediately after July 1974 sales, the price of sandalwood oil in the export market slumped sharply. In view of this the next sale, which was due in December 1974, was postponed by Tamil Nadu Government till March 1975 in order to find out whether the market for sandalwood oil would revive. However, in March 1975 sales the average prices were only Rs. 23,332 at Tirupattur and Rs. 16,343 at Sathyamangalam. The sales of most of the lots were not confirmed with a view to preventing further sliding down of the oil price and to stabilising the market. The situation in Karnataka with regard to the export of sandalwood oil is similar.

Non-traditional Items

43.3.22 Amongst the non-traditional items, for which greater efforts should be made for increased export, mention may be made of rosin, gum *ghatti*, *kuth* root, *nux-vomica* (*Strychnos nux-vomica* Linn.) dried ripe seed, sandalwood chips and dust, palmarosa oil and vetiver oil. The prospective market for each product should be identified and necessary promotional work undertaken. It has been recognised that lack of quality control had led to an appreciable fall in the country's export. We have already suggested compulsory 'agmark' grading for the groups of products discussed earlier. Such compulsory grading rules and quality control should also be introduced and enforced for non-traditional products.

43.3.23 There is a potential field in the export of rosin, and planning ahead is necessary. The production of rosin so far was considered sufficient only for meeting the internal requirement, and as such no efforts were made for the export of rosin, except for some sporadic attempts by Himachal Pradesh Government factories and the Indian Turpentine and Rosin Co., Bareilly, during 1966-67 and 1967-68. The Government of India formed a Central Coordination Committee for rosin and turpentine oil in 1971 under the chairmanship of the Inspector General of Forests to review the working of the industry in the country and to propose measures for increasing production. As a re-

sult of various efforts made as per recommendations of the Committee, there was a steep increase in the oleoresin production in the country. However, the internal consumption of rosin did not increase to the extent estimated earlier. Keeping in view the trend of higher production and lesser internal demand, vigorous efforts were initiated during 1973-74 to enter the international market for export of rosin and the Central Coordination Committee fixed a target of 1,500 tonnes for export during 1973-74. The Chief Conservator of Forests, Himachal Pradesh was made coordinator for arranging export of rosin from Government-owned factories of Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir which produce 55 to 60 per cent of the country's rosin. Due to a late start, only 950 tonnes of rosin was shipped to UK, West Germany, Italy and France to earn foreign exchange worth about Rs. 32.23 lakhs. For the year 1974-75, an export target of 7,000 tonnes has been fixed by the Central Coordination Committee.

43.3.24 The main rosin buyers in the international market are West Germany, Japan, UK, France, Brazil and Canada, and also some other West European countries. Severe competition is expected from other exporting countries, e.g. China, Mexico, Spain and Greece. The rosin industry in India should gear up to meet the challenge of the international market by improving quality of its products and packing, ensuring strict quality control, as well as by undertaking an extensive sales drive in the various rosin buying countries. However, turpentine oil produced in the country has a ready market in the turpene based industries which have come up in the country and there is no scope at present for the export of turpentine oil.

4 ORGANISATION

43.4.1 The development of MFP has suffered due to inadequate appreciation of its importance. Quantitatively, the collection of MFP is not much of a problem. If a labourer is assured adequate wages, he will collect the material, no matter how difficult the job is. At present minor forest products are, by and large, collected and marketed through private contractual agencies. But the trend is changing as the State Governments have realised the importance of MFP as a high revenue earner and have set the pattern by arranging collection departmentally, or through tribal development corporations and/or forest labourers' cooperative societies. The available information is as follows :

- (i) In Madhya Pradesh, Maharashtra, Rajasthan, Orissa, Andhra Pradesh and Uttar Pradesh, *tendu* leaf trade has been nationalised and the collection of *tendu* leaves and their disposal

are done under the provisions of *Tendu Nationalisation Acts*.

- (ii) In Maharashtra trade in *apta* leaves is nationalised. Same is reported to be the case in Madhya Pradesh regarding gum *karaya* and bamboo.
- (iii) Sandalwood oil is extracted departmentally in Karnataka and Tamil Nadu.
- (iv) *Harra* is collected departmentally in Maharashtra and Madhya Pradesh.
- (v) *Katha* manufacture and collection of bamboo are done departmentally in Rajasthan.

43.4.2 The main shortcomings and considerations in collection and marketing may be summarised as below :

- (i) Most of the minor forest products occur in widely scattered areas making economic exploitation difficult. Furthermore, they are often found in difficult and inaccessible terrain where the mode of transport is either non-existent or primitive.
- (ii) Some of the products are perishable and available only for a short season. Their timely collection and storage assume great importance. Since a large number of products are annual and perishable, their non-collection and non-utilisation mean a resource wasted and consequent loss to the economy.
- (iii) Collection is resorted to from the forests in the vicinity of villages, while it is generally neglected or ignored from the interior forests.
- (iv) At the time of collection hardly any attention is paid to the procurement of good quality material. Adulteration, with motive of larger gains, is practised at all levels.
- (v) Unscientific methods and over-exploitation result in dwindling of production and scarcity of the product.
- (vi) Though it may not be possible to engage labour on a whole-time basis, the collectors who are mostly tribals do not get either sustained employment or reasonable remuneration in the present system.

43.4.3 In order to overcome the above shortcomings, it is necessary to modernise the institutional and organisational set-up for the procurement and utilisation of MFP. Such a step has been found to be quite rewarding. In Madhya Pradesh the revenue from *tendu* leaves was about Rs. 80 lakhs per year when leased out to contractors. After nationalisation, the receipts have gone up to Rs. 9 crores, and the expectation is that they will increase further. The collectors are getting far better wages, i.e. Rs. 16 per standard bag of 37 kg (1 *maund*)

of leaves which can be collected in two days, as against hardly Rs. 4 when they were working for the contractors. Another example is the tapping of resin from pine trees in Jammu & Kashmir. In 1973-74, the State public sector corporation undertook tapping through villagers paying them on piece rate basis and the yield per blaze rose from 1.5 kg to 3.0 kg. Whole-time employment was created and the wages increased to about Rs. 10 per day as against part-time employment under the intermediaries when the earnings of the tappers were much less. The production of crude resin for the last few years was:

	(quintals)
1971-72	23,000
1972-73	28,000
1973-74	471,700
1974-75	166,700

Experience of other States, which have nationalised the trade in certain products and adopted improved techniques, is similar. These facts show how a correct approach can create favourable conditions in the economy of the local people and the State.

43.4.4 The main task of the organisation would be to :

- (i) survey areas having natural concentration of produce for economic exploitation, and those fit for raising crops yielding MFP ;
- (ii) promote necessary research regarding techniques, economics, introduction of exotics, etc.
- (iii) improve and develop methods of collection and marketing of MFP, and undertake infrastructural development in relatively inaccessible areas for fuller exploitation;
- (iv) assure collection of desired quality and control of quality up to the stage of marketing;
- (v) undertake processing where necessary; and
- (vi) provide facilities for warehousing and transport.

43.4.5 We have given careful thought to what should be the optimum arrangement for the development of MFP, namely increasing production, ensuring fair price to producers/collectors, introducing new species, boosting export, diversifying industrial products, etc. We recommend that States with sizeable resources of a particular item of MFP, or groups of products, may each set up a Minor Forest Products Corporation exclusively for collection, processing and marketing of the material handled. In other States, it would be desirable to have a

separate forest circle devoted exclusively to this work. We are definitely not in favour of any elaborate field set-up for collection of MFP whatever be the organisational arrangement. For normal management of the forests, Forest Departments maintain a regular field staff posted in the interior areas. The services of the normal field staff should be utilised for collection of MFP by the tribals and others and for disbursing the payments for the material collected. Suitable honoraria should be paid to these field personnel for undertaking this work and the State Governments should permit acceptance of honoraria by them. The actual collection and at least the initial processing should be done either by direct recruitment of labour or through labour cooperative societies, and the system of intermediaries should be abolished. In Appendix 43.9, we have given the revenue obtained by sale of MFP in different States for the years 1967-68, 1968-69 and 1969-70. It gives only a rough idea of the importance of MFP in these States.

43.4.6 We should emphasise that it would be the primary responsibility of the State Forest Departments to develop the MFP resource and to utilise them for the benefit of the national economy. The MFP corporations would have to be manned by competent technical personnel, with suitable training in various fields of expertise required in production, collection, processing, marketing, export, etc. In our Interim Report on Production Forestry—Man-made Forests, we have recommended that the personnel of the forest corporations should normally be on tenure deputation from the Forest Departments. The same arrangements should be followed in respect of the MFP corporations.

43.4.7 Survey of MFP would have to be taken up by the national forest survey organisation, to be set up as recommended in Chapter 46 on Forest Planning, Research and Education. The survey should aim at collecting data on the distribution of MFP, their processing, grading, storage, transport, marketing, prices, utilisation, etc. Wherever corporations come to be established, they should actually promote, and simultaneously extend financial support, for investigation concerning MFP. Similarly for research, no separate organisation is necessary, but the corporations should promote research in the existing or future organisation for forest research in the States.

43.4.8 Nationalisation of trade in certain products is advocated. Generally, nationalisation could start with such products as *tendu* leaves, sandalwood, gum *karaya*, bamboo, myrabolan, resin, etc., and gradually extended to other products. Sandalwood oil industry should also be nationalised, as already mentioned in paragraph 43.2.12 Na-

tionalisation would not by itself be enough. Labour should be trained in proper and methodical collection. Training camps need to be organised to ensure proper training for collection without damage to plants and for quality control and grading. The trained labour could be encouraged to form labour cooperative societies. Training of forestry personnel in marketing strategy is called for.

43.4.9 The development of MFP based industries should be carefully planned and developed on commercial lines. For this purpose, corporation can be set up as a subsidiary to the principal MFP corporation in a State. However, in States where corporations may not be set up, and there is only a departmental organisation for development of MFP, the MFP based industries should nevertheless be set up only on commercial principles.

43.4.10 The industries processing MFP should be located wherever possible, near the source of raw material, and provision should be made for proper storage and marketing of the products, including timely transportation to consumer centres. In order to increase the profitability of such industries and to secure higher production, it may also be necessary to raise plantations of concerned species, exotic or indigenous.

43.4.11 It is our opinion that institutional finance should be secured for the development of MFP in the States having a high potential. The setting up of corporations would facilitate the flow of institutional finance. In addition, sufficient outlay should be allocated in the plan for short and long term investment for the survey of resources, research and development in silviculture, product utilisation and marketing, grading, packing and storage. In the States where the setting up of corporations is not possible, adequate plan outlay should be made.

43.4.12 There should be an organisation at the all-India level for tackling different matters connected with export of MFP, particularly for the following purposes:

- (i) to ensure quality control, particularly for such products as have export value;
- (ii) to undertake market research both within the country and abroad and disseminate information to the State minor forest produce corporations and Governments;
- (iii) to undertake promotional activities for local sales and for export; and
- (iv) to gather information on production costs and sale prices and disseminate knowledge about the same to the sellers and buyers.

5 EMPLOYMENT

43.5.1. A very large part of rural population mostly tribals, residing in villages in or near the forests, collect various MFP in the seasons when these are ready for collection — either for their own use or for the Government or for contractors on payment. *Tendu* leaves are collected during April-May, when the new flush of leaves is maturing. *Sal* seeds fall with the pre-monsoon showers and are collected from under the trees. *Harra* (chebulic myrabolan) is collected when it is shed on ripening in the early cold weather. Naturally exuded gum *karava* is collected throughout the year, except during the rains. Tannin barks are generally collected from felled areas. Leaves are collected whenever required, but tannin fruits only after they are ripe. Pine trees are tapped for resin during warm and hot weather. Edible products are collected whenever they are mature. The seasons for cultivation and collection of lac are spread over a large part of the year. Thus, the activities concerning MFP are carried out almost all the year round, though certain months of the year are a more busy time for the cultivator/collector.

43.5.2 The collection and processing of various MFP are seasonal, and villagers — men, women and children — go out on the work when they have hardly any other occupation, to supplement their earnings. But there has been no comprehensive survey of employment in forestry activities so far. In the Forest Statistics Returns prescribed by the Directorate of Economics and Statistics, Ministry of Agriculture & Irrigation, a table is prescribed for reporting employment of labour in forest and forest industries with consumption of wood and MFP. The table is expected to show the number of persons employed annually (300 man-days being taken as equivalent to one person) in (a) management (silviculture) and (b) extraction under the broad head of 'forestry' showing the quantities of wood used and values of MFP. There are difficulties in attaining any accuracy for MFP with this approach because the MFP is usually collected by middlemen, mostly through the tribals, who are paid a very low wage as compared to what they get under departmental working.

43.5.3 The Sub-Committee on Minor Oilseeds of the Ministry of Agriculture & Irrigation, Government of India¹ indicated the employment potential in the collection of some minor oilseeds of tree origin. The availability of oil from these oilseeds in 1970-71 was 59,000 tonnes and it was estimated to be 123,000 tonnes in 1973-74. The employment was shown as under:

¹ 1971. Report of the Sub-Committee on Minor Oilseeds : pp 23-24. New Delhi. Ministry of Agriculture & Irrigation, Government of India.

TABLE 43.8

Employment in Collection of Minor Oilseeds of Tree Origin (1970-71)

Commodity	Production in tonnes		Collection of seed per man-day (kg)	Employment (man-days)
	Oil	Seed kernel		
<i>mahua</i>	25,000	71,428	10	7,142,800
<i>neem</i>	20,000	100,000	20	5,000,000
<i>karani</i>	7,000	25,900	10	2,590,000
<i>kusum</i>	3,000	9,000	15	603,000
<i>sal</i>	3,125	25,000	15	1,675,000
<i>kokam</i>	200	500	10	50,000
others	675	1,687	10	168,700
total	59,000	233,515		17,229,500

It was concluded: "The employment potential is created in the tribal areas where it is most needed. Moreover, these seeds are collected mostly by women and children of the weaker sections of the community. Larger collections would, therefore, go a long way towards providing gainful employment to the labour force particularly non-viable farmers and agricultural labourers. It is roughly estimated that with the increase in collection of these seeds, equivalent to about 1.28 lakh tonnes of oil, the annual employment potential would be about 389 lakh man-days, i.e. more than two times the employment provided at present.....The schemes under the Small and Marginal Farmers and Agricultural Labourers Development Projects have been taken up in some of the tribal districts and increasing employment in rural areas is one of the important objectives of these schemes. As the collection of minor oilseeds has a great employment potential, the scheme for increasing the collection of seeds, particularly through labour cooperatives, should find favour with these agencies for suitable assistance."

43.5.4 An estimate for current employment from the national standpoint may be made with reference to the gross value of output of MFP. The latest year for which the value of output is available

is 1969-70. The estimated gross value of output of MFP at current prices between 1965-66 and 1969-70 is given below:

	(Rs. crores)
1965-66	87.99
1966-67	95.24
1967-68	100.65
1968-69	108.26
1969-70	108.08

As mentioned, the MFP are collected by tribals and others living in or near the forests, and the buyers are generally the contractors and lessees of the Forest Departments. The marketing is done practically in the forest itself, or with only a very short lead. We, therefore, estimate that 75 per cent of the gross value of output is contributed by the wage component. The average wage paid is very low compared with that paid to the agricultural labourers. The tribals and others are known to have worked in the recent past in many parts of the country with as low a wage as Rs. 1.50 or Rs. 2 per day. Even assuming the average wage rate to be Rs. 3 per day, the employment offered in the collection of MFP during 1967-68 to 1969-70 had not been less than 250 million, man-days.

43.5.5 There are many other activities, like collecting grass, grazing cattle in the forests, etc., which are important as a source of employment in the rural economy, but which are not easy to be estimated in terms of man-days. Again, before the produce comes to the market, some form of labour intensive activities are carried out by the collectors, and this adds substantially to the employment. For instance, *sal* seeds are roasted or dried, and then dewinged and decorticated mostly by hand. Mechanical decorticators have been devised now and may be introduced when large scale collection is organised. This selective mechanisation may have no effect on employment, because the time of collection is short and the period in which the fruits should be processed without losing their marketability is very limited. Without this level of mechanisation, a large part of the collection for the market may never be made and the potentiality of employment due to increased collection may be lost.

43.5.6 Taking all aspects into consideration, we are of the opinion that present employment in the harvesting of MFP is not less than 250 million man-days. We have discussed in paragraph 43.5.3 the increase in employment opportunity in the production of minor oilseeds of tree origin alone. In 2000 AD the oil production from minor oilseeds of tree and shrub origin is expected to rise by about 20 times over 1970-71 level. There will be corresponding effect on employment opportunity. There are other areas where substantial additional employ-

ment would be generated, e.g. eleoresins, gums, tannins, *tendu* leaves, essential oils, etc. Accordingly, if proper investments are made and organisational support given for attaining the potential production of MFP, the employment by 2000 AD can go up easily to 1,000 million man-days.

43.5.7 It will not be correct to convert the man-days into the number of persons in whole-time employment by taking 300 man-days for one person. The fact that the employment is seasonal severely limits such an analysis. The employment through collection, etc. of MFP should be considered as alleviating seasonal unemployment and/or underemployment, and contributing to an increase in the income level of rural households, rather than be projected as full-time employment for a certain number of persons. We have indicated in the previous section about the organisation needed for the development of MFP. The organisation should undertake, if necessary, in consultation with sociology departments of universities or competent institutes, a study of seasonal unemployment or underemployment of rural labour, nature of additional work desired by them and terms on which their labour will be available, in areas where potentiality of development of MFP exists. These studies will form the basis for monitoring the projects for development of MFP and presenting a clear picture to the Government of the employment potential of the project.

43.5.8 In Chapter 41 on Forest Policy, we have recommended in paragraph 41.7.10 that the intermediary contractors in the harvesting of produce must be eliminated. The system we have recommended would not only give better wages and sustain gainful employment to the collectors, but would also help in developing resources better. In some parts of the country, wages are paid in kind. This gives scope for unfair deal to the tribals. The wages should always be paid in cash, but they must be linked to productivity and incentive plans prepared to get higher collection, within the planned limits, and improved quality of products. When a produce is collected on a piece rate basis there should be adequate safeguards to ensure that the produce collected is of requisite quality and specifications. For instance, in the case of *tendu* leaves, unless a careful check is made, the smaller or damaged leaves might be collected or even the bundles might contain lesser number of leaves. Another example is *Artemesia*, which is a rare medicinal herb in the country, collected in Jammu & Kashmir. The collections are usually found mixed with unwanted stems and other parts of the plants to make up the bulk. Since inflorescence is the main part containing the active principles, the yield of the product from this herb would be low in such cases, and economics of processing and utilisation would be adversely effected. It was found recently that by linking the production with quality checks by way of sample

testing in terms of percentage yield of the final product, the quality of the herbs supplied improved, and so did profitability. The final payments on account of supplies are now linked up only with the results of sample tests.

6 SUMMARY OF RECOMMENDATIONS

43.6.1 Some of the more important recommendations are summarised below:

1. There should be a uniform legislation on the possession and transit of sandalwood applicable to all the States.

(Paragraph 43.2.12)

2. Export of sandalwood billets should be gradually reduced, and instead distillation of oil and the products of cottage industries based on sandalwood carving should be developed for export.

(Paragraph 43.2.12)

3. The tempo of artificial regeneration of sandalwood in afforestation programmes in sandal bearing areas should be increased, and possibilities of growing sandal in other parts of the country explored. The research on sandal spike disease should be intensified.

(Paragraphs 43.2.13 and 43.2.14)

4. A target of production of 1.2 million tonnes of oil by 2000 AD should be planned through the use of various minor oilseeds of tree and shrub origin. Necessary incentives should be given to industries for using larger quantities of such minor oilseeds.

(Paragraphs 43.2.21 and 43.2.25)

5. Research and extension efforts should be directed towards popularising the deoiled *sal* meal for cattle and poultry feed.

(Paragraphs 43.2.24 and 43.2.25)

6. A survey of *harra* tree (*Terminalia chebula* Retz.) should be taken up to determine the total number of trees and the average yield of drupes per tree in order to estimate the production of myrabolan. Experiments regarding the successful raising of myrabolan plantations mixed with other species should be undertaken. Plantations of exotic species, like wattle and *Schinopsis lorenzii* Engl., should be extended.

(Paragraphs 43.2.31 and 43.2.32)

7. Well equipped factories for the manufacture of tannin extracts from all tannin yielding materials should be set up as early as possible to maximise the earnings from exports. Existing capacities for myrabolan crushing should be fully utilised, and new capacity added, in order that more and more crushed myrabolans may be exported.

(Paragraph 43.2.37)

8. An effective coordination must be established between the national and State agencies responsible for production of tannin bearing raw materials, their industrial processing and export.

(Paragraph 43.2.37)

9. For *katha* manufacture, availability of raw material of required specifications and in quantities within economic lead should be assured over a period. Steps should be taken to take up a more scientific method of production to reduce wastage.

(Paragraphs 43.2.39 and 43.2.42)

10. To increase the production of gums from existing natural resources, the methods of collection have to be improved. Future availability may be increased by raising new plantations.

(Paragraph 43.2.46)

11. Apart from adopting better methods of collection of pine resin, the installed capacity of the Government factories should be augmented, so that a larger percentage of crude can be processed. With a view to increasing export of resin, its quality should be improved by installing modern machinery. The industry should take up diversification of products for import substitution.

(Paragraph 43.2.50)

12. In order to meet the requirements of different types of vegetable drugs and insecticides, attempts should be made to improve collection of raw materials from forests. A study should be undertaken, and reviewed from time to time, regarding the future requirement of vegetable drugs and pyrethrum. Cultivation of concerned plants should be undertaken in suitable localities in forest areas.

(Paragraphs 43.2.52 and 43.2.55)

13. The production of good quality *bidi* leaves should be increased and wastage avoided by improving the methods of collection, transport, grading and storage. Research should be initiated or intensified in relation to pruning/pollarding of trees, pest control, rotational working, regeneration, etc.

(Paragraphs 43.2.59 and 43.2.61)

14. Cultivation, processing and marketing of lac should be considered as an integral industrial venture. The activities concerning lac cultivation and processing should be taken up as parts of both drought prone areas programme and tribal development programme.

(Paragraph 43.2.71)

15. Wide fluctuations in lac production experienced in the past should be minimised and increase in production to be achieved by :

- (i) arranging supply of broodlac to needy cultivators.
- (ii) taking suitable extension measures;
- (iii) arranging suitable demonstrations; and

- (iv) guaranteeing a minimum remunerative price to the primary producers.

(Paragraphs 43.2.71 and 43.2.72)

16. Arrangements for marketing and storage of the primary products, namely sticklac and seedlac, should be streamlined. There should be an effective link up between State minor forest produce organisations, cultivators' cooperative societies, manufacturers of shellac and exporters.

(Paragraphs 43.2.73 and 43.2.74)

17. Research on selection and management of host plants, finding out new hosts, etc. for lac should be intensified. Effective control of lac predators, broodlac preservation, improvements in processing techniques, etc. should be subjects of further intensive study.

(Paragraphs 43.2.75 and 43.2.76)

18. Attempts should be made to take up wood distillation commercially after making a thorough feasibility study, specially in areas from where extraction of fuelwood is uneconomical.

(Paragraph 43.2.78)

19. Greater attention should be paid to identified traditional markets for each kind of produce. Market intelligence should be collected from abroad. Agmark standards for all important items of MFP should be developed and enforced to ensure confidence in Indian products. A pre-shipment inspection by the national export organisation should be made compulsory.

(Paragraphs 43.3.3 and 43.3.22)

20. A study of the problems of increasing export of gum *karava* should be undertaken. Tapping of gum *karava* on scientific lines should be introduced in all the concerned States.

(Paragraph 43.3.8)

21. More concentrated efforts should be made to develop the widely varied markets for export of lac products, and to gear their production, quality control, etc. Benefit of increasing export prices should be passed on to the cultivators/collectors.

(Paragraphs 43.3.10 and 43.2.72)

22. Export of *bidi* leaves should be channelised through a national export organisation for forest products.

(Paragraph 43.3.17)

23. Amongst the non-traditional items, greater efforts should be made for increased export of rosin, gum *ghatti* (obtained from *Anogeissus latifolia* Edgew.), *kuth* (*Saussuria lappa* C.B.Cl.) root, *nux-vomica* (*Strychnos nux-vomica* Linn.) dried ripe seed, sandalwood chips and dust, palmarosa oil and vativer oil.

(Paragraph 43.3.22)

24. The States with sizeable resources of a particular products, or groups of products, may each set up a Minor Forest Products Corporation exclusively for collection, processing and marketing of the material handled. In other States, it would be desirable to have a separate forest circle devoted exclusively to this work. Collection should be arranged through normal field staff of the Forest Departments and they should be paid honoraria for the purpose.

(Paragraph 43.4.5)

25. The actual collection and at least the initial processing of minor forest produce should be done either by direct recruitment of labour or through labour cooperative societies, and the system of intermediaries should be abolished.

(Paragraph 43.4.5)

26. The development of minor forest produce resources and their utilisation for the benefit of the national economy should be the primary responsibility of the State Forest Departments. The minor forest produce corporations should be manned by competent technical personnel with suitable training.

(Paragraph 43.4.6)

27. The survey for minor forest produce by the State inventory organisations should aim at collecting data on the distribution, processing, grading, storage, transport, marketing, prices, utilisation, etc. Wherever corporations come to be established, they should promote, and simultaneously extend financial support, for the investigation.

(Paragraph 43.4.7)

28. Nationalisation should be resorted to in respect of trade in certain products, like *tendu* leaves, sandalwood, gum *karava*, bamboo, myrabolan, resin, etc. Sandalwood oil industry should also be nationalised.

(Paragraph 43.4.8)

29. Labour should be trained in proper and methodical collection, quality control and grading. The trained labour should be encouraged to form labour cooperative societies. Forestry personnel should be trained in marketing strategy.

(Paragraph 43.4.8)

30. The industries processing minor forest products should be located wherever possible near the source of raw material, and provision should be made for proper storage and marketing of the products, including timely transportation to consumer centres.

(Paragraph 43.4.10)

31. There should be an organisation at the all-India level for tackling different matters connected with export of minor forest produce, particularly for ensuring quality control, undertaking market

research and export promotion, and gathering and disseminating information on production costs and sale prices.

(Paragraph 43.4.12)

32. With proper investments and organisational support on the lines recommended, it should be possible to increase the present employment level of 250 million man-days to 1,000 million by 2000 AD. Such employment should be regarded as alleviation of seasonal unemployment/underemployment.

(Paragraph 43.5.7)

33. Wages should always be paid in cash and linked to production with quality checks by way of sample testing in terms of yield of final product. Incentive plans should be prepared to get higher collection and better quality of products.

(Paragraph 43.5.8)

APPENDIX 43.1

(Paragraph 43.2.49)

Yearwise Progress of Government Rosin and Turpentine Factories in Himachal Pradesh¹

Item	1950-51	1955-56	1960-61	1965-66	1970-71	1973-74
production of crude rosin (quintal)	22,558	61,156	92,713	112,427	143,900	172,940
quantity and percentage of crude processed (quintal)	17,665 (78.3)	18,032 (29.3)	28,370 (30.6)	34,147 (30.4)	101,280 (70.4)	99,164 (57.3)
finished products						
(a) rosin—						
quantity (quintal)	12,365	13,747	21,054	26,278	76,474	74,194
value (Rs. lakhs)	..	9.55	22.57	35.64	186.59	251.14
(b) turpentine—						
quantity (kilolitre)	333	309	515	669	1,929	1,865
value (Rs. lakhs)	..	1.02	2.05	6.69	21.22	23.00

¹ Chief Conservator of Forests, Himachal Pradesh—private communication.

MINOR FOREST PRODUCE

APPENDIX 43.2

(Paragraph 43.3.1)

Value of Exports of Minor Forest Produce from India¹

Item	Rs. lakhs									
	1961-62	1969-70	1970-71	1971-72	1972-73	1973-74	Total 1971-72 to 1973-74	Average 1971-72 to 1973-74	Percentage of figures in col. 9 to total of col. 9	
1	2	3	4	5	6	7	8	9	10	
I. plants for use in dyeing and										
tanning	1,16.18	71.59	51.32	86.04	38.06	79.95	2,04.05	68.02	2.46	
myrabolan <i>amla</i>	13.66	0.29	0.27	0.13	0.43	0.52	1.08	0.36	0.01	
myrabolan fruit extract	38.10	2.87	3.01	4.78	8.67	3.64	17.09	5.70	0.21	
myrabolan others	1.28	45.26	20.89	56.92	7.41	33.93	98.26	32.75	1.18	
all others	63.14	23.17	27.15	24.21	21.55	41.86	87.62	29.21	1.06	
II. natural gums, resins and										
balsams	1,97.74	4,25.70	5,32.28	5,24.56	5,20.94	6,13.91	16,59.41	5,53.14	20.02	
gum <i>karava</i>	1,17.91	3,72.60	4,09.28	3,93.32	3,28.74	4,43.37	11,65.43	3,88.48	14.06	
all others	79.83	53.10	1,23.00	1,31.24	1,92.20	1,70.54	4,93.98	1,64.66	5.96	
III. lac and lac products										
seedlac	4,66.45	4,77.78	4,99.66	6,59.15	6,18.52	14,39.56	27,17.23	9,05.74	32.78	
hand-made	1,22.80	74.76	70.16	1,22.07	76.13	1,84.18	3,82.38	1,27.46	4.61	
shellac machine-made	3,01.63	1,26.00	1,21.35	1,43.65	1,50.86	3,57.25	6,51.76	2,17.25	7.86	
button and garnet lac	2.51	2,39.17	2,66.86	3,53.25	3,35.89	7,84.18	14,73.32	4,91.11	17.78	
other lacs	23.10	32.44	33.62	38.95	50.68	1,13.78	2,03.41	67.80	2.45	
	16.41	5.41	7.67	1.23	4.96	0.17	6.36	2.12	0.08	

IV. vegetable materials used for										
plaiting	38.87	3.88	7.36	4.57	20.76	18.00	43.33	14.44	0.52	
bamboo	-	0.19	2.92	1.33	6.49	10.24	18.06	6.02	0.22	
bamboo and bamboo canes										
split used for plaiting	16.51	0.98	1.99	0.86	10.67	1.10	12.63	4.21	0.15	
canes	5.19	2.25	1.99	2.15	3.19	3.20	8.54	2.85	0.10	
rattan and rattan canes	0.57	0.42	0.14	0.05	0.08	0.12	0.25	0.08	neg	
all others	16.60	0.04	0.32	0.18	0.33	3.34	3.85	1.28	0.05	
V. plants, seeds, etc. used in										
perfumery, pharmacy, etc.	2,82.18	4,07.30	5,55.41	6,41.04	4,96.08	8,67.91	20,05.03	6,68.34	24.20	
kuth root	3.21	15.87	9.50	4.89	8.00	8.49	21.38	7.13	0.26	
psyllium husk	60.44	1,38.49	2,54.66	3,63.49	1,67.83	2,99.08	8,30.40	2,76.80	10.02	
psyllium seed	3.42	12.12	20.31	27.37	49.91	34.13	1,11.41	37.14	1.35	
sandalwood chips and dust	-	4.44	8.70	5.91	4.98	13.24	24.13	8.04	0.29	
senna leaves & pods	17.57	57.05	54.43	53.01	58.71	2,00.91	3,12.63	1,04.21	3.77	
all others	1,97.54	1,79.33	2,07.81	1,86.37	2,06.65	3,12.06	7,05.08	2,35.02	8.51	
VI. bidi leaves										
	1,27.46	88.48	92.82	74.26	1,10.25	73.89	2,58.40	86.13	3.12	
VII. essential oils resinoids										
eucalyptus oil	4,51.07	4,28.36	3,75.93	3,89.08	4,08.05	6,10.04	14,00.59	4,66.86	16.90	
ginger grass oil	0.01	0.03	0.01	neg	1.80	11.33	13.13	4.38	0.16	
lemongrass oil	0.15	0.17	0.10	-	-	1.11	1.11	0.37	0.01	
palmarosa oil	2,36.03	1,05.11	78.00	78.92	94.81	2,06.64	3,80.37	1,26.79	4.59	
sandalwood oil	10.86	25.76	24.96	17.05	10.41	16.57	44.03	14.68	0.53	
vetiver oil	1,93.21	2,74.76	2,45.40	2,60.99	2,78.20	3,51.16	8,90.35	2,96.78	10.74	
all others	1.97	2.98	2.36	0.81	2.17	1.18	4.16	1.39	0.05	
	8.84	19.55	25.10	31.31	20.66	22.05	67.44	22.47	0.82	
total	16,79.95	19,03.09	21,14.78	23,78.70	22,12.66	37,03.26	82,88.04	27,62.67	100.00	

neg — negligible.

Compiled from the Statistics of the Foreign Trade of India, Calcutta. Directorate General of Commercial Intelligence and Statistics, Government of India.

MINOR FOREST PRODUCE

APPENDIX 43.3

(Paragraph 43.3.1)

Volume of Exports of Minor Forest Produce from India¹

Item	1	2	3	4	5	6	7	8	9	10	Quantity—tonnes
								Total 1971-72 1973-74 to	Triennium average 1971-72 1973-74 to	Percentage of figures 1971-72 in col. 9 to total of col. 9	
I. plants for use in dyeing and											
tanning		27,926	12,693	5,452	9,335	2,818	7,461	19,614	6,538	13.23	
myrabolan <i>amla</i>		6,845	69	44	21	66	61	148	49	0.10	
myrabolan fruit extract		15,262	221	196	-207	306	135	648	216	0.44	
myrabolan others		52	10,546	2,815	6,872	638	4,711	12,221	4,074	8.24	
all others		5,767	1,857	2,397	2,235	1,808	2,554	6,597	2,199	4.45	
II. natural gums, resins and											
balsams		11,491	7,003	10,281	10,670	9,277	9,089	29,036	9,679	19.58	
gum <i>karaya</i>		4,569	5,030	5,666	5,787	4,357	5,657	15,801	5,267	10.65	
all others		6,922	1,973	4,615	4,883	4,920	3,432	13,235	4,412	8.93	
III. lac and lac products											
seedlac		29,991	16,739	13,346	13,721	7,564	5,608	26,893	8,964	18.13	
shellac		6,709	3,719	2,596	3,352	997	944	5,293	1,764	3.57	
shellac handmade		11,497	4,384	3,262	3,059	1,896	1,465	6,420	2,140	4.33	
shellac machine made		142	6,826	5,882	6,327	3,854	2,661	12,842	4,281	8.66	
button and garnet lac		1,096	1,291	1,027	938	695	536	2,169	723	1.46	
other lacs		1,547	519	579	45	122	2	169	56	0.11	

IV. vegetable materials used for plaiting.

bamboo	20,536	444	1,250	597	2,582	3,207	6,386	2,129	4.30
bamboo and bamboo canes	..	9	708	373	1,810	2,461	4,644	1,548	3.13
split used for plaiting	15,878	352	437	151	591	189	931	310	0.62
cane	515	75	88	66	127	106	299	100	0.21
rattan and rattan cane	33	7	3	neg	1	7	8	3	neg
all others	4,110	1	14	7	53	444	504	168	0.34
V. plants seeds etc. used in perfumery, pharmacy, etc.	17,319	14,842	16,163	18,334	15,534	22,005	55,823	18,624	37.67
kuth root	88	375	196	67	102	102	271	90	0.18
psyllium husk	1,801	2,162	2,883	5,211	2,055	3,239	10,505	3,502	7.08
psyllium seed	318	637	800	1,072	1,926	1,003	4,001	1,334	2.70
sandalwood chips and dust	..	336	422	372	414	431	1,217	406	0.82
senna leaves and pods	2,048	3,578	3,544	3,664	3,110	4,231	11,005	3,668	7.42
all others	13,064	7,754	8,318	7,948	7,927	12,999	28,874	9,624	19.47
VI. bidi leaves	8,427	3,986	3,723	2,779	3,960	2,317	9,056	3,019	6.10
VII. essential oils, resinoids	1,054	396	383	461	456	554	1,471	450	0.99
eucalyptus oil	neg	neg	neg	neg	25	39	64	21	0.04
ginger grass oil	neg	neg	neg	..	..	1	2	1	neg
lemongrass oil	910	226	190	262	265	367	894	298	0.61
palmarosa oil	19	18	26	14	13	10	37	12	0.02
sandalwood oil	92	108	104	118	120	93	331	110	0.22
vetiver oil	2	1	1	neg	1	neg	1	neg	neg
all others	31	43	62	67	32	43	142	48	0.10
total	107,744	56,103	50,598	55,897	42,191	50,241	148,329	49,443	100.00

neg — negligible.

1 Compiled from the Statistics of the Foreign Trade of India, Calcutta. Directorate General of Commercial Intelligence and Statistics, Government of India.

APPENDIX 43.4

(Paragraph 43.3.4)

Region-wise Export of Myrabolan¹

Economic region	1969-70		1970-71		1971-72		1972-73		1973-74	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
0. Africa	3	0.07	244	3.92	neg	neg	neg	neg	..	..
1. North America	625	2.52	..	..	600	9.33	234	2.11	..	..
2. Latin America . . . . .	..	..	..	..	..	..	..	..	..	..
3. Other American countries . . . . .	..	..	..	..	..	..	..	..	..	..
4. ESCAP countries (including China)	456	4.23	231	3.08	268	4.84	427	5.55	379	4.91
5. Other Asian and Oceanian countries and Arctic and Antarctic Regions	9	0.05	24	0.20	neg	neg	7	0.15	2	0.02
6. East European countries	50	0.61	24	0.52	122	1.26	182	5.28	74	2.04
7. European Common Market countries	9,692	40.99	2,531	16.44	6,109	51.38	159	3.37	4,452	31.10
8. European Free Trade Area countries . . . . .	..	..	..	..	..	..	..	..	..	..
9. Other European countries . . . . .	..	..	..	..	..	..	..	..	neg	neg
total	10,835	48.41	3,054	24.16	7,100	61.83	1,010	16.50	4,907	38.09

neg — negligible.

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta. Directorate General of Commercial Intelligence and Statistics, Government of India.

APPENDIX 43.5

(Paragraph 43.3.7)

Region-wise Export of Gum *Kataya*¹

Economic region	1969-70		1970-71		1971-72		1972-73		1973-74	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
0. Africa	neg	0.02	..	..	1	0.07	neg	0.06	5	0.26
1. North America	29.54	201.20	3,541	245.83	3,600	224.24	2,683	194.72	2,830	201.73
2. Latin America . . . . .	..	..	..	..	..	..	..	..	..	..
3. Other American countries . . . . .	..	..	..	..	..	..	..	..	..	..
4. ESCAP countries (including China)	89	9.06	63	5.92	60	6.09	113	10.50	110	11.74
5. Other Asian and Oceanian countries and Antarctic and Arctic Regions	1	0.12	neg	0.02	neg	0.04	3	0.81	neg	0.05
6. East European countries	40	3.32	85	7.42	189	13.60	155	11.52	266	22.50
7. European Common Market countries	1,945	158.86	1,977	150.10	1,933	149.14	1,400	111.37	2,443	206.96
8. European Free Trade Area countries . . . . .	..	..	..	..	..	..	..	..	..	..
9. Other European countries	neg	0.02	..	..	3	0.14	3	0.25	3	0.13
total	5,000	372.60	5,666	409.29	5,787	393.33	4,357	328.73	5,657	443.37

¹ The totals in quantity may not tally in certain cases to approximation.

neg — negligible.

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta. Directorate General of Commercial Intelligence and Statistics, Government of India.

APPENDIX 43.6

(Paragraph 43.3.12.)

Statement I—Region-wise Export of Seedlac¹

Economic region	1969-70		1970-71		1971-72		1972-73		1973-74	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
0. Africa . . . . .	..	..	1	0.02	..	..	..	..	..	..
1. North America	1,429	28.98	1,495	38.36	1,827	64.15	81	2.71	7	1.75
2. Latin America . . . . .	..	..	19	0.58	11	0.41	17	1.52	4	0.60
3. Other American countries . . . . .	..	..	..	..	..	..	..	..	..	..
4. ECAP countries (including China)	58	1.27	16	0.46	34	1.19	57	3.26	30	4.30
5. Other Asian and Oceanian and Antarctic and Arctic Regions . . . . .	..	..	1	0.02	..	..	..	..	..	..
6. East European countries	24	0.50	1	0.02	19	0.58	..	..	..	..
7. European Common Market countries	2,208	44.88	1,055	30.70	1,461	55.74	843	68.65	902	177.24
8. European Free Trade Area countries . . . . .	..	..	..	..	..	..	..	..	1	0.28
Other European countries . . . . .	..	..	..	..	..	..	..	..	..	..
total	3,719	74.78	2,598	70.16	3,352	122.07	998	76.14	944	184.17

* The totals in quantity may not tally in certain cases due to approximation.

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta. Directorate General of Commercial Intelligence and Statistics, Government of India.

(Paragraph 43.3.12)

Statement II—Region-wise Export of Shellac—Hand-made¹Quantity—tonnes
Value—Rs. lakhs

Economic Region	1969-70		1970-71		1971-72		1972-73		1973-74	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
0. Africa	24	0.75	39	1.62	40	2.03	9	1.21	119	30.82
1. North America	1,035	28.32	665	23.98	630	29.39	335	26.46	295	68.16
2. Latin America	464	14.17	330	12.72	492	25.05	152	12.65	129	41.42
3. Other American countries	2	0.06	..	..	5	0.23	1	0.05	..	..
4. ESCAP countries (including China)	339	10.19	236	9.89	314	15.91	98	9.62	139	38.48
5. Other Asian and Oceanian countries and Antarctic and Arctic regions	9	0.29	..	..	7	0.39	3	0.31	3	1.31
6. East European countries	1,501	44.14	892	30.41	300	14.12	355	26.99	48	7.30
7. European Common Market countries	902	24.93	1034	39.98	1213	53.34	901	69.71	694	158.94
8. European Free Trade Area countries	35	1.03	29	1.16	24	1.39	22	2.41	27	6.10
9. Other European countries	73	2.12	37	1.59	34	1.80	20	1.25	20	4.72
total	4,384	126.00	3,262	121.35	3,059	143.65	1,896	150.86	1,465	357.25

¹ Compiled from the Statistics of the Foreign Trade of India. Calcutta.
Directorate General of Commercial Intelligence and Statistics, Government of India.

APPENDIX 43.6—(contd.)

(Paragraph 43.3.12)

Statement III—Region-wise Export of Shellac—Machine-made¹

Economic region	1969-70		1970-71		1971-72		1972-73		1973-74	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
0. Africa	242	8.28	307	11.33	118	6.87	244	27.26	159	43.32
1. North America	445	19.03	487	22.09	734	38.31	430	38.94	102	27.34
2. Latin America	567	18.68	1,346	58.56	1,010	56.05	356	25.50	398	127.08
3. Other American countries	..	..	neg	neg	neg	0.04	neg	0.03	..	..
4. ESCAP countries (including China)	1,550	52.53	1,373	66.17	1,411	83.20	692	72.76	867	246.27
5. Other Asian and Oceanian and Antarctic and Arctic Regions	87	3.46	43	2.57	100	6.21	45	4.65	49	18.07
6. East European countries	2,283	70.04	948	37.03	1,026	51.42	895	70.51	481	154.08
7. European Common Market countries	1,439	58.90	1,192	58.31	1,494	85.79	1,023	83.07	560	156.72
8. European Free Trade Area countries	59	2.50	93	5.27	61	4.89	40	3.87	18	4.40
9. Other European countries	154	5.75	93	5.52	373	20.47	129	9.30	27	6.90
total*	6,826	239.17	5,882	266.85	6,327	353.25	3,854	335.89	2,661	784.18

¹ Compiled from the Statistics of the Foreign Trade of India. Calcutta.

Directorate General of Commercial Intelligence and Statistics, Government of India.

* The totals in quantity may not tally in certain cases due to approximation.
neg — negligible.

(Paragraph 43.3.12)

Statement IV—Region-wise Export of Button and Garnet Lac¹

Economic region	1969-70		1970-71		1971-72		1972-73		1973-74	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
0. Africa	neg	0.01	..	..	2	0.08	1	0.09	neg	0.01
1. North America	703	15.90	346	10.37	330	12.26	262	19.18	149	29.03
2. Latin America	3	0.12	21	0.95	44	1.82	17	1.93	12	3.58
3. Other American countries . . . . .	..	..	..	..	..	..	..	..	..	..
4. ESCAP countries (including China)	24	0.69	31	1.12	49	2.14	18	1.54	21	5.12
5. Other Asian and Oceanian and Antarctic and Arctic Regions	neg	0.01	1	0.07	neg	0.01	3	0.18	1	0.13
6. East European countries	3	0.07	50	1.87	2	0.09	1	0.05	9	2.43
7. European Common Market countries	531	14.95	532	17.72	486	21.46	390	27.55	342	73.21
8. European Free Trade Area countries	9	0.20	23	0.71	19	0.79	3	0.11	..	..
9. Other European countries	19	0.48	24	0.80	8	0.30	1	0.05	2	0.27
total*	1,291	32.43	1,027	33.61	938	38.95	695	50.68	536	113.78

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta Directorate General of Commercial Intelligence and Statistics, Government of India.

* The totals in quantity may not tally in certain cases due to approximation.

neg — negligible

APPENDIX 43.7

(Paragraph 43.3.16)

Regionwise Export of Psyllium Husk¹

Economic Region	1969-70		1970-71		1971-72		1972-73		1973-74	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
0. Africa	2	0.22	1	0.18	1	0.13	2	0.24	1	0.18
1. North America	172	109.41	2,491	219.87	4,448	306.94	1,401	113.13	2,650	244.05
2. Latin America	..	..	..	..	..	..	..	..	3	0.29
3. Other American countries	..	..	..	..	..	..	..	..	..	..
4. ESCAP countries (including China)	121	9.19	37	3.39	91	7.22	28	4.41	54	5.30
5. Other Asian and Oceanian and Antarctic and Arctic Regions	1	0.17	3	0.29	neg	0.05	neg	0.06	1	0.14
6. East European countries	..	..	..	..	12	0.88	..	..	..	..
7. European Common Market countries	317	19.50	351	30.92	656	48.10	628	49.98	530	49.11
8. European Free Trade Area countries	..	..	..	..	2	0.16	..	..	..	..
9. Other European countries	..	..	..	..	..	..	..	..	..	..
total*	2,162	138.49	2,883	254.65	5,211	363.49	2,055	167.82	3,239	299.07

* The totals in quantity may not tally in certain cases due to approximation.

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta, Directorate General of Commercial Intelligence and Statistics, Government of India. neg — negligible.

APPENDIX 43.8

(Paragraph 43.3.19)

Region-wise Export of Sandalwood Oil¹

Economic region	1969-70		1970-71		1971-72		1972-73		1973-74	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
0. Africa	5	14.20	8	16.26	6	13.64	3	8.06	1	3.14
1. North America	9	22.50	14	31.64	33	70.30	44	101.94	7	24.16
2. Latin America . . . . .	..	..	neg	0.03	..	..	..	..	..	..
3. Other American countries . . . . .	..	..	..	..	..	..	..	..	neg	0.14
4. ESCAP countries (including China)	7	18.36	8	20.85	8	17.49	10	22.73	10	42.60
5. Other Asian and Oceanian countries and Antarctic and Arctic Regions . . . . .	..	..	neg	0.53	neg	0.11	..	..	..	..
6. East European countries	35	91.27	33	76.32	30	63.25	16	35.11	50	201.27
7. European Common Market countries	45	108.81	32	77.41	35	179.49	39	90.50	19	63.54
8. European Free Trade Area countries	7	18.62	9	21.87	7	16.07	8	18.51	4	14.91
9. Other European countries	neg	1.00	neg	0.48	neg	0.64	1	1.36	neg	1.40
total*	108	274.76	104	245.40	119	260.99	120	278.20	93	351.16

* The totals may not tally due to approximation in individual regions.

¹ Compiled from the Statistics of the Foreign Trade of India, Calcutta, Directorate General of Commercial Intelligence and Statistics, Government of India. neg — negligible.

APPENDIX 43.9

(Paragraph 43.3.5)

Revenue Derived from Minor Forest Produce in India¹

(in lakhs)

States/Union Territories	1967-68		1968-69		1969-70	
	Revenue from major forest produce	Revenue from minor forest produce	Revenue from major forest produce	Revenue from minor forest produce	Revenue from major forest produce	Revenue from minor forest produce
1	2	3	4	5	6	7
Andhra Pradesh	344.38 (55.6)*	375.39 (44.4)	333.74 (51.2)	318.71 (48.8)	352.54 (59.0)	246.62 (41.0)
Assam (including Meghalaya)	192.80 (59.4)	131.76 (40.6)	198.49 (60.7)	128.69 (39.3)	202.08 (53.6)	174.79 (46.4)
Bihar	196.63 (58.1)	141.58 (41.9)	239.35 (57.3)	178.64 (42.7)	264.40 (65.8)	137.11 (34.2)
Gujarat	321.22 (85.8)	53.04 (14.2)	308.73 (86.6)	47.87 (13.4)	338.88 (76.6)	103.42 (23.4)
Haryana	8.54 (33.4)	17.04 (66.6)	5.76 (24.2)	18.03 (75.8)	29.76 (86.4)	4.68 (13.6)
Himachal Pradesh	533.35 (97.1)	15.71 (2.9)	561.36 (36.8)	18.82 (3.2)	632.78 (97.0)	19.57 (3.0)
Jammu & Kashmir	394.71 (96.3)	15.29 (3.7)	399.06 (91.6)	36.44 (8.4)	431.80 (88.1)	58.20 (11.9)
Karnataka	813.80 (73.6)	292.58 (26.4)	1,028.98 (76.9)	309.49 (23.1)	1,190.49 (85.0)	211.07 (15.0)
Kerala	693.98 (93.2)	50.29 (6.8)	760.38 (91.8)	68.11 (8.2)	836.67 (94.8)	46.22 (5.2)
Madhya Pradesh	116.36 (56.2)	904.59 (43.8)	1,436.83 (56.8)	1,091.36 (43.2)	1,608.26 (62.2)	977.87 (37.8)
Maharashtra	705.99 (79.6)	180.86 (20.4)	620.12 (76.8)	187.12 (23.2)	682.08 (79.3)	177.71 (20.7)
Manipur	2.87 (65.4)	1.52 (34.6)	2.93 (63.8)	1.66 (34.2)	2.90 (54.3)	2.44 (45.7)
Nagaland	3.27 (42.5)	4.42 (57.5)	3.13 (41.9)	4.34 (58.1)	15.01 (98.9)	0.17 (1.1)
Orissa	263.48 (54.6)	219.07 (45.4)	275.18 (48.8)	288.87 (51.2)	275.01 (41.8)	383.28 (58.2)
Punjab	41.86 (80.2)	10.31 (19.8)	58.72 (90.4)	6.27 (9.6)	56.35 (87.6)	7.98 (12.4)

APPENDIX 43.9 (contd.)

1	2	3	4	5	6	7
Rajasthan	32.55 (27.6)	85.23 (72.4)	25.18 (27.0)	68.12 (73.0)	6.35 (6.3)	93.83 (93.7)
Tamil Nadu	125.90 (37.2)	212.75 (62.8)	124.13 (36.9)	212.61 (63.1)	120.06 (35.8)	215.10 (64.2)
Uttar Pradesh	1,191.11 (68.0)	560.49 (32.0)	1,302.85 (68.2)	605.68 (31.8)	1,331.97 (65.9)	690.17 (34.1)
West Bengal	194.66 (89.1)	23.80 (10.0)	222.93 (89.0)	27.38 (11.0)	223.00 (91.1)	21.70 (18.9)
Tripura	9.23 (64.9)	4.99 (35.1)	12.17 (68.0)	5.71 (32.0)	13.12 (67.8)	6.25 (32.2)
Arunachal Pradesh	78.54 (84.8)	14.05 (15.2)	84.20 (85.7)	14.10 (14.3)	84.20 (85.7)	14.10 (14.3)
Andaman & Nicobar Islands	111.92 (91.8)	10.00 (8.2)	132.64 (93.7)	8.98 (6.3)	132.54 (92.3)	10.99 (7.7)
Delhi	0.11 (55.0)	0.09 (45.0)	0.05 (31.3)	0.11 (68.7)	0.05 (31.3)	0.11 (68.7)
Dadra & Nagar Haveli	8.27 (96.3)	0.32 (3.7)	3.87 (95.6)	0.18 (4.4)	7.54 (96.4)	0.28 (3.6)
Goa, Daman & Diu	9.28 (76.6)	2.84 (23.4)	11.65 (80.6)	2.80 (19.4)	12.90 (12.90)	3.90 (23.2)
all India	7,439.81	3,228.01	8,152.43	3,650.09	8,852.74	3,607.56
total	(69.8)	(30.2)	(69.0)	(31.0)	(71.1)	(28.9)

* Figures in brackets indicate percentages to total revenue.

1 1971. Forest Statistics Bulletin No. 12—Forest Revenue & Expenditure. New Delhi.
Central Forestry Commission, Ministry of Agriculture, Government of India.

FOREST ECOLOGY AND WILDLIFE MANAGEMENT

1 INTRODUCTION

44.1.1 The knowledge of elements of ecology helped man to search for food in different habitats and seasons. Though a predator by nature, man was conscious of the laws of Nature. Gradually, man began to exploit the natural resources unwisely. The economic needs dictated the felling of more and more of the forests to grow more food and extracting more and more of timber and fuel for domestic use and of raw materials for pulp and paper and many other forest products for innumerable needs. But very often the exploitation of water, soil and vegetation resources was done without acquiring sufficient knowledge of the ecological impact of different types of agricultural, silvicultural and pastoral land-use. Enough care was not taken in replacing the resources, even where it was possible to do so, as in the case of forests.

44.1.2 There has to be some equilibrium between the exploitation of the resources and their replenishment by Nature or by human effort in opening up new sources of energy and matter; between the transformation of natural habitat and the preservation of those elements in it which are needed for man's well-being. The point of equilibrium is, of course, subject to shift with development. But the conflict between man and Nature came into sharp focus, when it was found that man's exploitation of natural resources has wrought damages in the environment which neither the Nature's own forces could repair nor human efforts could overcome except perhaps at a prohibitive price or at the cost of other efforts destined to enhance human welfare and well-being. The environmental deterioration and the pollution that set in created a condition in the world to bring into dispute the economic theory of high growth rates without considerations for ecology. The result is man's increasing concern in the recent past over the deterioration of the biosphere, and over evolving a balanced and realistic approach which would take into consideration the relationship between environmental safeguards and rapid economic growth.

44.1.3 In maintaining the quality of the environment consistent with economic growth, the forests play an important part. This has been recognised by the UN Conference on Human Environment held in Sweden in 1972 and also by the National Committee on Environmental Planning and Coordination, Government of India. In this country, the destruction of forests, mainly due to socio-economic causes, is proceeding at an alarming pace, and the consequences should be better understood. Forestry and wildlife management do not involve major technological transformation of the landscape. Some of the less fragile forest ecosystems can be modified for human use. In modifying them, it is necessary to take into consideration the ecological aspects of commercial forestry or intensification of forest productivity. This chapter deals specifically with these issues, and with wildlife development in particular.

2 FOREST AND ENVIRONMENT

44.2.1 Forests are a powerful ecological unit affecting environment, as elsewhere in the world, and are among the most important natural and renewable resources. The outer Himalayas, the Western Ghats, the Deccan plateau including the Vindhya and the North Eastern Region comprising Assam, Arunachal Pradesh, Nagaland, Meghalaya and Mizoram are the main forested regions in this country.

44.2.2 The environment is taken to consist of all surrounding things, conditions and forces to which living matter is sensitive and capable of responding. The entire forest ecosystem complex, which has the atmosphere, the climate and the soil and its living organisms as its broad components, can thus be seen to influence the environmental quality. The complicated energy transfer in the forest ecosystems involves the atmosphere, plants, predators, herbivores, leaf litter and the soil and its microflora and microfauna. Alteration in any of these factors which are closely interrelated affects the total environment.

Beneficial Effects of Forest Ecosystem

44.2.3 The beneficial effects of a forest ecosystem on human environment consist in moderating the climate, maintaining the soil mantle, regulating the water supplies, purifying the air and helping in noise abatement. The forests also provide recreation.

44.2.4 Under the Indian climate, which generally has a long dry and often hot season followed by a short but often heavy rainfall period, the climatic benefits and the protective umbrella of forests

over soil are of great value. When properly managed, Forests contribute towards moderation of flow of water in the catchments, protection of soil against erosion by wind and water and other forms of soil degradation etc.

44.2.5 By their photosynthetic activity, the plants fix carbon dioxide from the atmosphere with concurrent release of oxygen and thus purify the air. According to Wiackowski¹, the leaf surface is 10 to 20 times greater than the earth surface occupied by the plants. Plants not only intercept many tonnes of dust, but also effectively change the concentration of harmful gases.

44.2.6 The forests also absorb noise and may serve as acoustic screens between busy highways, noisy industrial installations and human settlements between different ecosystems. Agricultural monoculture or cultivation of short rotation crops over extensive areas without buffers of forest ecosystems in this country has reduced the diversity of the ecosystems and simplified food chains, resulting in elimination of natural enemies and predators. This has created ideal conditions for multiplication of diseases, insects, rodents. etc., thus reducing the potential yield of foodcrops. It has been the experience in some parts of the country that the farmers were afraid of planting mango trees or growing orchards because of the monkey population migrating to villages and creating enormous problems for the farmers. The solution would lie in maintaining adequate ecological balance in forests so that birds and monkeys would not migrate to towns and villages. Similarly in roadside plantations, *Ficus* trees, *neem* (*Azadirachta indica* A. Juss.), etc. should be introduced along with other quick growing species, so that these trees could provide food to the birds, which would otherwise descend on the cultivated fields.

44.2.7 The forests represent a store-house for preserving the gene pools of species of plants, animals and micro-organisms. By providing a habitat for wildlife, they help in recreation, economic gains and widening of human mind by education and research in natural history. Wildlife plays an important part in the forest ecosystems and constitutes an important element of environment.

44.2.8 In view of the fact that forests are a vital element of environment and there are intricate mutual interactions between them and the environment, the planning and management of the forests have of necessity to reflect the concern for maintaining and improving the quality of environment. This concern, however, cannot disregard the productive function of the forests, which leads to economic betterment

¹ Wiackowski, S. K., 1975. Effects of and Amelioration of Air Pollution Damage to Forest Ecosystem. Paper presented to the Second FAO World Technical Consultation on Forest Diseases and Insects, New Delhi.

of the population. In this context, the following extracts from the recommendations of the First Session of Permanent Committee on Forestry of the Food and Agriculture Organisation (FAO) of United Nations (1972) are relevant:

"Forest production and protection of the environment are not necessarily incompatible but complementary, and there is a great need for foresters to communicate with the public so that the latter, who are sometimes misled by erroneous or emotional propaganda that forestry activities are contrary to the interest of environment, can be kept properly informed about such matters. Possibly the best way to merge and link the social and productive functions of forests is to make forestry a profitable undertakingForest management should provide for the maintenance of both the productive capacity and protective role of the forests, and recognition given to their value in the protection of other natural resources and in the enhancement of the environment."

Degradation and Deterioration in the Forests — Responsible Factors and their Effects on Environment

44.2.9 Human activities and to a much lesser extent natural factors are responsible for causing degradation and deterioration in the forests. The present pattern of human living is a complex one, unlike that of primeval man. It has wide ramifications in its effects on forests and denizens. Since forests constitute an important component of environment, any degradation or deterioration in their status is *ipso facto* an indirect degradation of human environment. The deterioration and degradation of forest habitat endangers the existence of wildlife, leading sometimes to the extinction of a species. Factors responsible for degradation and deterioration in the forests fall under the following broad groups: (a) disforestation, (b) defective methods of land-use, (c) fire, (d) insects and diseases, (e) pollution of environment and (f) natural factors.

44.2.10 The climatic deterioration resulting from disforestation has been highlighted in a study by Warren¹ on meteorological changes and disforestation in the Ranchi plateau from 1889 to 1940. According to Warren, adverse climatic changes appear to have taken place due to extensive disforestation in the Ranchi plateau and nearby areas of Bihar (Chota Nagpur) and Orissa. The average maximum temperature in June has increased and the average minimum winter temperature has decreased. The diurnal range of temperatures has increased in all months except July. Average monthly rainfall

¹ Warren, W.D.M., 1974. A Study of Climate and Forests in the Ranchi Plateau—Parts I & II, Ind. For., 100(4&5).

from March to June has decreased and so has average humidity from January to June. Although these variations have also been linked to the changes occurring in general circulation over Asia, it is likely that these may at least to some extent be the results of widespread forest destruction.

44.2.11 Increase of soil erosion from disforestation constitutes a severe impairment of the environment of the earth. Reckless destruction of forests in the Siwaliks in Punjab, Haryana and Himachal Pradesh has led to erosion and expansion of area under *chos*, as the following figures with regard to the Siwaliks in Hoshiarpur in Punjab will show :¹

Year						Area under <i>chos</i> (ha)
1852	...	...	...	...	...	19,523
1884	...	...	...	...	...	32,423
1897	...	...	...	...	...	38,163
1943	...	...	...	...	...	60,750

The soil loss by water erosion in a grazed *cho* area was found to be 22,442 kg per ha as compared to 306 kg per ha in grass and scrub land under similar slope and storm intensity. The soil and water conservation problem due to degradation and deterioration of forest cover has been dealt with in Chapter 42 on Production and Social Forestry and necessary recommendations have been made with regard to the steps to be taken in watershed protection.

44.2.12 Partial disforestation is caused by the practice of shifting cultivation. The total area of forest under shifting cultivation is progressively increasing and much of the forests are gradually getting bereft of all trees, causing serious imbalance in the ecology. The current practice of indiscriminate livestock grazing poses a threat of degradation to the forests. It is not as if the practice of forest grazing makes the animal husbandary of the areas concerned as the most productive one. The highest production of milk and milk products is achieved in areas which have almost no natural forests and consequently no forest grazing. It is not the grazing in forests *per se* which is harmful to the forests but it is the excessive and uncontrolled grazing which causes physical damage to vegetation, compaction or erosion of soil, competition for food plants for wild animals, gradual elimination of palatable plants and their replacement by unpalatable and less useful ones, spread of diseases, pests and weeds through animal vectors, etc. We have discussed the problems of shifting cultivation and forest grazing in Chapter 42 on Production and Social Forestry and made suitable recommendations.

¹ Sinha, R.L., 1957. The Problem of silt in relation to irrigation and river projects and role of forests. Proc. Fourth Irrigation and Power Seminar, Hirakud.

44.2.13 Fire is one of the most important agents causing deterioration of forests, though controlled burning is often used in forest management as an aid. We have discussed forest fires in some detail in Chapter 45 on Forest Protection and Law. Disforestation, or even intensive forest management with both natural and artificial regeneration, may throw the natural balance of ecosystem in disarray and create pests and diseases problems. The control of forest diseases and pests has been dealt with in Chapter 42 on Production and Social Forestry.

44.2.14 The general ill effects of polluting gases are changing of the water balance of plants, damage to tissues, weakening of photosynthesis, slowing down of growth, premature weakening and mortality of trees. Reduction of density of forests, decrease in wood quality and yield and deterioration of site quality are the end results of long and continuous pollution of air in the forest ecosystem. However, in this country industrialisation has not advanced so much that the pollution of the environment would have significant effect on the forests. But we have recommended in our Interim Report on Social Forestry that urban forestry should be developed as a part of recreational facilities to be provided to the urban communities. The pollution of environment will pose a great problem in urban forests and treelands, particularly where heavy emissions and effluents from various factories are likely to affect the forests. It has been found¹ in a study of heavily polluted urban forests in Japan that there was a decrease in height increment up to one-third and a drop in diameter increment in trees exposed to air pollution. There was an appreciable increase in the incidence of diseases and pests. Conifers were prone to suffer more than broad-leaved trees.

44.2.15 Natural factors are also responsible for causing local and sometimes widespread deterioration of forests. Frost is one of the important factors. In managed forests, if the management techniques, the silvicultural requirements of the species and the locality factors are not harmonised, frost may render stand establishment impossible. Frost scars on trees act as focal points for fungal infections. In the *sal* forests in the frosty areas all over Northern India, frost cankers serve as entry points of such heart-rotting fungi as *Trametes incerta* (Curry) Cooke and *Fomes carvophylli* (Racib.) Bres.² Drought is also responsible for degradation of forests. Some forests are subjected to repeated waves of drought and mortality of trees. It is found that the density of the forest is gradually reduced, and the soil undergoes a change for

¹ Inoue, T., 1975. The Injury Caused by Air Pollution in Japan. Paper presented to the Second FAO World Technical Consultation on Forest Diseases and Insects, New Delhi.

² Bakshi, B.K., 1957. Heart-rot in relation to Management of *Sal*. Ind. For., 83(11).

the worse.^{1, 2} Drought affected *sal* forests of Bihar, Orissa and Uttar Pradesh were found heavily attacked by the fungus *Hypoxylen mediterraneum* De Not. var. *microspora* Miller. The effect on wildlife is no less serious, due to drying up of water holes and feed.

44.2.16 There are other minor or local natural degrading agencies to which the forests are subject. Periodical changes in the climate and in the depth of water table, cyclonic storms, wind, avalanches, lightning and snow may be mentioned in this connection. Use of artificially planted forests has been made to ameliorate the ill effects of some of these factors. Raising of *Casuarina equisetifolia* Forest. In coastal areas, particularly in Orissa, has been done to lessen the fury of cyclonic waves, which invade the inland habitation, cultivation and forests and cause heavy loss of life and property.

44.2.17 While the natural factors, climatic or otherwise, causing deterioration and degradation of forests are in part uncontrollable, their vagaries can be minimised for both economic and ecological gains, by proper management techniques. It should be the effort of the forest management to develop such techniques by research and application of the results in the field.

44.2.18 Introduction of exotics or a new species may have both beneficial and harmful effects. The most familiar example is of *Lantana camara* Linn. introduced as a garden plant now invading grazing grounds, forests and fields. The spotted deer introduced in the Andamans has now almost attained the level of a pest. *Mikania Micrantha* H.B.K., *Eupatorium odoratum* Linn., *Ageratum conyzoides* Linn., *Argemone mexicana* Linn. and *Opuntia dillenii* Haw., all exotic weeds, are now posing difficult problems in the country. In order to reap the benefits of introduction of an exotic and at the same time reduce the chances of deterioration of forest environment to a minimum, it is necessary that the introduction of plants and wildlife species is effected only after thorough experiments on all aspects under strictly controlled conditions. In Chapter 42 on Production and Social Forestry, we have already dealt with the need for strict phytosanitary and post-entry quarantine, in the case of all imports of exotic propagating material.

3 ECOLOGICAL CONSIDERATIONS IN FORESTRY

44.3.1 The problems of landscaping in forestry and enhancing environmental quality are different in different types of forests, and

¹ Pande, D.C., 1956. Mortality in *Sal* Forests of Uttar Pradesh with special reference to recent mortality in Bahraich division. Proceedings of IX Sily. Conf., Dehra Dun.

² Seth, S. K., et al, 1960. *Sal* Mortality in Bihar, Ind. For. 86(11).

can be considered under the three main functional (cf. Paragraph 41.5.16) attributes of forestry:

- (i) protection forestry,
- (ii) production forestry,
- (iii) social forestry.

Protection Forestry

44.3.2 Protection forests — The instability of terrain in protection forests may be due to reasons of geology, nature of soil or slope of ground. Such areas where even the slightest disturbance of the forest cover is undesirable should be classed as protection forests. It will be useful to compile a list of purely protective forests for each of the States or Union Territories. It is obvious that very stringent tests will have to be applied to take out an area entirely from the orbit of productive forests and to earmark it for protection of terrain only. The other forests in mountain systems and river valley catchments can and should be developed and managed simultaneously both for production of timber and for environmental values. The protection forests offer scope of development as Nature reserves, and also for use for educational or research purposes. Protection afforded to these forests is guarantee enough for preservation of landscape. But excessive enthusiasm to cover every bit of land with trees must be guarded against. Open glades or treeless tops and slopes in the hills like the Nilgiri downs, open savannath grasslands in the *terai*, etc., should be left as part of the natural landscape.

44.3.3 Preservation plots and protected trees — Preservation plots are generally small areas selected in a particular forest type, and maintained free from biotic interference, to study the ecological succession of vegetation. Some preservation plots have also been established in plantation crops. Protected trees are those set apart as good examples for preservation as long as possible. The total number of preservation plots in India is 188 and the area occupied by them totals 8,422.35 ha. There are 33 out of a total of 60 climax subtypes of forests distinguished in the country where there are no preservation plots. So far as the larger number of edaphic and seral subtypes are concerned, these plots exist only in 3 and 1 subtypes respectively. Some of the preservation plots are very small in area. The smallest one is 0.01 ha and the largest 4,000 ha.¹ It is necessary that the coverage of preservation plots, both as regards subtypes represented and area under each subtype, is increased to attain a fair percentage of all the recognised subtypes. As increasingly larger areas are being

¹ 1975, Indian Forest Bulletin No. 271. Dehra Dun, Forest Research Institute & Colleges.

clearfelled and converted into man-made plantations and some subtypes of forests are in danger of elimination, this has become urgent. The wide distribution canvas of each subtype between and within States should be well represented in the preservation plots. A list of protected trees in the country should be prepared by the Forest Research Institute (FRI), and deficiencies discovered regarding coverage of important species should be made good by joint action of the State Forest Departments and the FRI.

44.3.4 The management of preservation plots needs to be improved. It is probable that many preservation plots have their sanctity violated. All the preservation plots should be fenced properly and their sanctity, i.e. freedom from felling of trees, clearing shrubs and fallen leaves, fires, cattle-grazing, etc., guarded. Ecologists from universities should be associated with research in these plots in addition to silviculturists. These plots should not be opened for recreational uses.

44.3.5 Nature reserves — Nature reserves are much larger areas than preservation plots and cover several forest types. The idea behind formation of these reserves is to preserve comparatively larger forest areas under virgin or near virgin conditions to serve as gene pool reserves for the threatened species.¹ Forest Departments of the States and Union Territories should demarcate at least a few such reserves. These reserves should be open to educational and research uses. A larger number of Nature reserves can also be created in the areas falling under the category of wetlands. The wetlands* are of great importance for scientific, agricultural, hydrological, economic and scenic values, apart from being natural habitats of waterfowl.

44.3.6 Wilderness areas — These denote unspoiled areas, where wildness, vastness, remoteness and grandeur have a special appeal for naturalists and others seeking a respite from the crowds and mechanisation of present day life. The presence of some of the highest eternally snow-covered mountain peaks of the world in the States of Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh constitutes a generous natural endowment in this direction. As many of these areas as possible should be kept free from despoilation by activities like mining, road-building and construction. This idea is enshrined in local folklore in many places, where certain peaks are devoted to deities and

¹ 1973. Man and Biosphere (MAB)—12. Programme on MAB. Expert Panel on Project 8 : Conservation of Natural Areas and of Genetic Material.

* According to the Convention on Wetlands of International Importance especially as Waterfowl Habitat adopted by the International Conference on the Conservation of Wetlands and Waterfowl held at Ramsar, Iran, January 30—February 1971, "wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres".

are inviolable. This consideration, however, has necessarily to be subordinated to the larger interests of defence against external dangers.

Production Forestry

44.3.7 The ever-increasing demand for timber, fuelwood and various other forest products has led man to modify the natural forest ecosystem to maximise the production of desired products. The development of various silvicultural systems in forest management has followed increase in demand of wood in various forms and sizes on the one hand and the need to adjust operations under these systems to the ecological characters of the site and the silvicultural requirements of the species on the other. The various silvicultural systems of production forestry can be arranged in a descending order of ecological bias which also represents an ascending order of economic bias. The sequence would be thus : (a) selection, (b) irregular shelterwood, (c) uniform, (d) strip and wedge, (e) coppice with standard, (f) simple coppice, and (g) clearfelling.

44.3.8 Selection and irregular shelterwood systems — In the selection system, and to a lesser extent in the irregular shelterwood system, the conservation of the environmental quality is achieved to the maximum extent. These are aesthetically the most attractive systems and afford the maximum protection to the resource base against climatic vagaries. Natural regeneration relied upon in these systems keeps more or less intact the shrubs, herbs, humus layers, microflora and microfauna of the forest. Economically, however, these systems have shortcomings and disadvantages. Their use should be confined to : (a) areas exposed to severe vagaries of Nature, soil erosion, landslips and avalanches, and (b) species whose silvicultural characters favour these systems. Areas where conservation of water supply, minimisation of silt discharge, moderation of floods and other environmental considerations are of prime importance should be worked under these systems.

44.3.9 The selection system of forest working causes the least disturbance, and as such creates least problems regarding maintenance of landscape. Aesthetic bias has, however, to overrule strict silvicultural considerations at times by slight adjustments. A large flowering tree of majestic mien dominating a landscape deserves to be retained in preference to silvicultural promptings which may favour its removal. The management principles should provide for such adjustments.

44.3.10 Forests worked under irregular shelterwood system have a little problem. In this case sacrifice of forest cover over some concentrated areas does not permanently harm the landscape as the new regeneration, on growing to larger size, creates a landscape of no mean value. The temporary change in forest cover generally provides a

landscape which has its own aesthetic value. The replacement is by the same species which originally formed the landscape and so perpetuation of the natural landscape is ensured. In the process of replacement the marginal areas tend to change appearance due to aggressive species trying to encroach but generally such aggressions tend to disappear with time and original cover conditions tend to a re-establish. A little leaning in favour of species of aesthetic value ensures improvement in the landscape where there is fear of deterioration. In many working plans such leanings are provided for and deserve to be given due importance in actual working. Artificial regeneration is often provided for in shelterwood working to supplement natural regeneration. Such operations become necessary in voids created by natural or artificial calamities and also by natural processes. In case of voids created by calamities artificial regeneration is a legitimate work, from the conservation as well as the financial point of view. Differentiation has, however, to be made of these from natural voids which should be left as a part of natural landscape.

44.3.11 Uniform and strip and wedge systems — The typical application of uniform system is in the coniferous forests of the Western Himalayas in Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir. These forests offer higher economic advantages than the selection forests e.g. high level spruce and fir forests. Environmental effects can be improved and the effect of fellings on wildlife minimised, by making the intensity of seeding, secondary and final fellings light under this system. In the case of strip and wedge system, the number of standards and reserves excluded from fellings can be increased and the width of strips and wedges can be increased with the same effect.

44.3.12 Although the stress in these systems is on natural regeneration, it need not be a necessary condition. The natural regeneration, where not adequate, may be supplemented by artificial regeneration, if a technique for the 'supplemental natural regeneration' can be evolved and implemented.

44.3.13 Coppice systems — Coppice forestry is prevalent in large areas covering low, hilly tracts of comparatively poor soils and to a lesser extent in case of valuable stocks on fertile soils such as *sal* forests of southern West Bengal or of eastern Uttar Pradesh. As other methods of regeneration are difficult in such areas coppice has to be depended upon for replacement of stock. This type of working involves clearfelling of large areas and so involves sudden change in landscape. Considerable skill is needed to avoid displeasing effects in managing such forests. Environmental considerations have to be carefully balanced with silvicultural considerations and convenience of working. The various considerations which have bearing on the aesthetics are selection of suitable standards, where these are retained, distribution of

coupes and arrangements of their size and shape. Much can be done in the selection of standards to maintain and, in fact, even to improve the aesthetics of an area. Handsome well-formed crowns of trees of pleasant foliage and trees bearing colourful flowers at various seasons can make up for the loss of green cover in the coupes and in fact can even improve the effect. The arrangement of coupes is important in coppice forestry. Long coupes running from top to bottom of a slope with straight sides are unsightly and look unnatural. Coupes following a horizontal lay out are more pleasing. The general lay of the ground must be kept in view while deciding the arrangement of coupes on the ground. It is necessary that the shape and size of the coupes should be in balance with the physical features of the land.

44.3.14 Clearfelling system — In recent years plantation forestry has been adopted on a large scale in most of the States. The need for growing quickly the more valuable and useful trees in place of natural and less valuable stock has been felt almost everywhere to meet the challenge of industry. It has been realised that raising forests by plantation is the quickest way of achieving these results and consequently plantations are being raised in ever increasing extent. *Eucalyptus* spp, tropical pines, teak, *sal*, some exotic conifers in Eastern Himalayas. etc., and even coffee, tea and rubber, are being raised by clearfelling and planting. This type of working involves wholesale elimination of the existing cover and replacement by a new type of cover. There is a considerable time lag between the disappearance of the old cover and the appearance of an effective new cover. The new cover is aesthetically of a different type. In planning plantations, therefore, great skill is needed to avoid, as much as possible, or to ease out and compensate for, the shocks to the landscape inherent in the system.

44.3.15 Generally the arrangement of shape and size of the plantation coupes should be governed by the same considerations as discussed in case of coppice forestry. In case of plantation forestry of today, however, the coupes are getting larger and larger from financial considerations as concentration of working is cheaper. For combining the environmental values with production forestry, natural forest may be left between successive coupes and along natural features such as ridges, streams and depressions, and also a few unfelled groups here and there. In plantations of pure species, the monotony can also be broken by planting flowering, or otherwise handsome and impressive trees along roads or at important points such as the crossings and around the huts of the watchers. In case of plantation of mixed species, monotony effects can be avoided by growing an intimate mixture of silviculturally accommodating species rather than growing a single species in a block.

44.3.16 Clearfelling has been practised on a moderate scale for over a century and many of the environmental ill effects have either not been confirmed, or have been countered by appropriate measures, or just have not made sufficient impact to warrant curtailment of use of this system. For the past 20 years man-made forestry has increased in tempo and now it has come to be recognised as the only way of bridging the gap between demand and supply of wood and fibres in a reasonably short time.

44.3.17 A safeguard against likely environmental ill effects is a correct identification of programme area. In our Interim Report on Production Forestry — Man-made Forests, we have given broad guidelines on this point. The State forest research organisations should evolve guidelines in practical terms for selection of areas for man-made forestry.

44.3.18 The various alternatives in choice of species, plantation technique, spacing, mixture, tending, rotation and protection should be decided not only with regard to short-term and economic considerations but also from the larger and long-term view of effects on the total ecosystem. The aim should be to salvage as much of the beneficial components of the natural forest ecosystem as possible while conducting the inevitable replacement of the top storey by the chosen fast growing species. All techniques and operations should be directed to this end. In addition, the precautions indicated in paragraph 44.3.15 above should be taken. The techniques and practices to be evolved should particularly take into account the needs for making up the loss of soil nutrients, control of pests and diseases, protection from fire, phytosanitary safeguards in importing propagating material, etc., so that a synthesis of economic and ecological values can be brought about. It may be mentioned even at the risk of repetition that the ecological imbalance is not necessarily caused by large scale commercial forestry. Many countries, like UK, West Germany, Hungary, etc., take out a wood production of 3 to 4 m³/ha/yr on the gross forest area, without an impairment of environmental values. In this country, the total wood production at present may not be much above 0.3 m³/ha/yr on the gross forest area, and all that may be necessary to obtain self-sufficiency in the nineties is to take it to about 1.0. Environmental degradation is more due to the myopic disforestation by the States to find a short-term solution of the problem of providing and to the landless and due to the economic conditions of the rural people who take to continued destruction of forest cover to earn a livelihood by sale of pilfered forest produce. Disappearance of wildlife is mainly due to unregulated hunting.

Social Forestry

44.3.19 In our Interim Report on Social Forestry, we have indicated forestry programmes to meet the production and recreational needs of the community. There is much common ground between social forestry and environmental forestry. In the following few paragraphs, we discuss the ecological considerations necessary to govern the implementation of our recommendations on extension forestry on lands on the sides of roads, canal banks and railway lines, mixed forestry on wastelands, *panchayat* lands, village commons, etc. and recreation forestry.

44.3.20 Planting on sides of roads, canals, etc. — Thousands of kilometres of roads and canals traverse the countryside. Frequently these pass through areas of drab landscape particularly in the North Indian plains. The land strips on the sides of the roads, canals and railroads generally belong to the Government. We have indicated a programme to bring such areas under extension forestry in our Interim Report on Social Forestry. It is possible to use these strips for creating better aesthetic effects along with meeting other demands.

44.3.21 Uniform stretches of the same species along a highway are quite pleasing for some distance but it would be quite monotonous if the uniformity continues too far. Sometimes variations become necessary on account of variation in local factors, of soil, terrain etc. but occasionally variety has to be introduced from aesthetic considerations as well. A large weird banyan tree with branches spreading over the road surface, seen from a long distance at the end of a uniform avenue of *sissoo* (*Dalbergia sissoo* Roxb.) can provide a more effective impression than a tree of normal shape and size of the major species. In the same way a projecting *gul mohar* (*Delonix regia* (Boj) Raf.) branch full of flowers can brighten the avenue. Careful planning of species for shade, smoothness and colour is, therefore, necessary in creating effective roadside avenues. The practice of planting a couple of flowering trees at every kilometre stone has been followed in Uttar Pradesh with good results. In the selection of species for the roadsides, hardness of the species and its form should be the main considerations.

44.3.22 Planting of continuous lines of avenue trees may become undesirable on special considerations. With the fast moving traffic on the national highways, continuous strips of avenues may sometimes obstruct view of beautiful landscape of the rural areas. It is, therefore, desirable that whenever the highways pass through some interesting landscape, planting should be adjusted with suitable gaps to make viewing possible.

44.3.23 In recent years the land strips along roads have been planted by multiple rows instead of in single rows. This has been done with impressive success in Haryana, Punjab and Uttar Pradesh. Such multiple rows provide a pleasing effect for the motorists and other travellers and also provide a handsome landscape feature in addition to achieving fuller utilisation of the available land. Wherever land is available multiple rows should be aimed at.

44.3.24 The same principles should be followed for planting on canal banks and sides of railway lines. Strips of varying width exist along banks of the canals of the various river systems. Such lands also belong to the Government and are capable of being planted for meeting the local demands of timber and fuel and also for industrial purposes. In some States, e.g. Uttar Pradesh, the State Forest Departments have been called upon to plant these strips to the best advantage of the State. Some of these strips have been under forestry operations for a number of decades and are managed under working plans for raising plantation of various species. Generally the site conditions are favourable and very useful plantations have been raised. These plantations provide an inspiring break in the landscape of the rich agricultural countryside, otherwise deficient in tree growth. Aesthetic consideration should be kept in view while stocking these strips, particularly at central points such as crossings with roads and railways and near habitations. Mixtures of trees of good shape and foliage and ornamental flowering trees should be favoured in such localities.

44.3.25 Some of the shade tree species which can be mixed for aesthetic effect, even while taking up plantations on the roadsides, canal banks, etc. on commercial considerations are: *neem*, tamarind, mango, *sissoo*, *mahua* (*Madhuca logifolia* (Koenig) MacBride), *putranjiva* (*Putranjiva roxburghii* Wall.), *jaman* (*Syzygium cumini* (L.) Skeels), *karanj* (*Pongamia pinnata* (Linn.) Pierre) and *nahor* (*Mesua ferrea* Linn.) for the plains and walnut, *deodar*, silver oak, willows, poplars, *Cupressus* spp., horse chestnut (*Aesculus indica* Colebr.), *kharak* (*Celtis australis* Linn.) and Gregg's pine (*Pinus greggii* Engelm.) for the hills. A large number of ornamental trees, indigenous as well as exotic, are available for planting in India. *Gul mohr* *Bauhinia* spp., *Cassia fistula* Linn., *C. Javanica* Linn., *C. nodosa* Ham *Peltophorum pterocarpum* (DC) Baker ex K. Heyne and *Jacaranda mimosaefolia* D. Don for the plains and *Melia azedarach* Linn., *Robinia pseud-acacia* Linn., *Aesculus assamica* Griff. and *A. indica* are some of them.

44.3.26 Sveral stretches of highways and railroads pass through natural forests. In the normal working of these natural forests economic considerations are likely to prompt the foresters to extend clearing of forests right upto the highways and railroads, in course of

routine fellings. Such bared patches are unsightly and leave an undesirable impression on the travellers. The traveller should, on the other hand, get an impression of traversing through deep forests. Natural strips of such minimum depth, as may be necessary keeping local conditions in view, should, therefore, invariably be preserved on both sides of the track so that the clearing done behind may not be visible. Minimum depth to be preserved should be prescribed in the working plans or project plans after considering local factors such as forest type, importance of the lines of communication, etc. Similarly while constructing roads and paths, slides, chutes, etc. for extraction of forest produce, particularly where they take off and are visible from the main roads, aesthetic consideration should not be lost sight of.

44.3.27 Mixed forestry on wastelands etc. — That forests should be raised in every village in vacant land and in other suitable places for meeting the timber, fuel and fodder requirements of the villagers has long been realised. The species selected should be those which can be easily grown and which can be protected from damage by man and cattle with reasonable certainty. Such forests generally improve the landscape of the countryside, as houses and huts along with agricultural fields and the tree growth in forest, or in isolation, create a composite picture pleasing to the eye. Better landscape effects are achieved by easing out the edges of the copses so grown and adding a few ornamental species in more frequented or frequently viewed site. Introducing a few trees like banyan, *pipal* (*Ficus* spp) and *semul* (*Bombax ceiba* Linn.) which are ornamental as well as attract birds by their flowers and fruits is a wise step as the birds attracted by the trees add colour and life to the country scene.

44.3.28 Recreation forests—The urban population needs a break from its busy, tiring and unhealthy routine. As every one cannot go to distant national parks or forests, it should be possible for the States to bring part of Nature closer to the city dwellers. This can best be achieved by developing pieces of land in or near cities into forest parks, gardens, etc. These green patches should be well distributed to function as city lungs. In some cities, the local administrations have already shown an awareness of this need, and parks and gardens have been developed in available land. As maintenance of gardens is expensive, larger areas can be planted with suitable trees and shrubs to provide a forest atmosphere. Along fringes, flowering trees, shrubs and creepers should be planted to give an impression of specially looked after areas. Such forest parks are generally very popular and contribute to the general uplift of the health of the urban population. Skilful planning of the species to be grown, planting patterns to be followed, alignment and specification of the roads and paths with the idea of creating and maintaining natural forest character, is necessary to create

effective landscapes in such parks. Existing forests in or near cities should not be felled or released for industrial or other purposes and in fact should be given legal protection by declaring them as Reserved or Protected Forests. Rocky backgrounds of cities and towns should also be preserved.

44.3.29 In recent years there has been a better appreciation of the need for outdoor recreation. Forests which are easily approachable from cities are being developed as recreation forests. In these forests, provision is generally made, against forest background, for facilities such as shelters, cafes, guest houses, holiday huts, children's parks, picnic places and facilities for viewing wildlife. With increasing interest in outdoor recreation such developments are bound to be more and more popular and the Forest Departments will be called upon to make them a regular feature of environmental development. Such recreation forests have to be developed primarily with aesthetic considerations, and planning of such forests would need the joint effort of experts in various fields such as forestry, horticulture, architecture and engineering.

Structures in Forest Landscape

44.3.30 For administration and management of forests, it is necessary to construct roads and bridges, ropeways, watch towers, administrative buildings, forest rest houses, forest colonies, labour camps, on-site sawmills, etc. To meet the demand for water of staff and workers living in the forests, small dams and storage tanks are required to be constructed and pipe lines to be laid.

44.3.31 These structures are necessary for efficient working. But they should be so planned that aesthetics in the forests are preserved. Without any thought to aesthetics, ropeway stations are built on promising beauty spots, forest rest houses located to have a commanding view of the landscape, streamlined concrete and glass buildings, often multistoreyed, constructed and generally painted white. The siting and design of these structures not only spoil the landscape but also disturb the wildlife. In a beautiful forest area, even a forest road in which night drives are prohibited or traffic regulated has trees on both sides of the road marked with broad bands of white and black, as in the case of highways. Natural roads with grass verges are often marked with boulders on both sides painted white. Instances can be multiplied of incongruous structures coming up in the forests with scant regard for aesthetics. So far as national parks, wildlife sanctuaries and Nature reserves are concerned, the design and siting of all structures should be put up for approval by the Indian Board of Wildlife (IBWL) or the State Wildlife Advisory Boards concerned, before any

construction starts. In particular, care should be taken not to create multistoreyed or large concrete structures that do not merge well with surrounding forests. In other forest areas, the Forest Departments should take particular care of aesthetics and generally follow the trends set by the Wildlife Boards.

44.3.32 Advertisement hoardings have started coming up in the forests, specially on roads to hill stations. Large signboards are often erected along forest roads giving detailed information about plantations, not always required for inspecting officers. The general policy in this regard should be to prohibit all private hoardings, and the signboards of plantations etc. should be small and inconspicuous. They should be fixed so as not to obstruct the natural features. There is no need to provide kilometre-stones on forest roads. Only at important road crossings or near forest establishment, attractively designed signboards may be put up giving the requisite information.

4 WILDLIFE DEVELOPMENT

44.4.1 Despite lack of scientific management, India is still very rich in variety of wildlife*. This country has larger number of representatives of both the Asian and the European species. There are eight species of deer, more varieties of cats than in any other country, several forms of wild goats, the Asiatic lion, the one-horned rhinoceros, the Indian elephant, etc. The climatic variations of the country, ranging from the near desert of the western region to the high rainfall regions of Eastern and Southern India and from the hot humid tropics to the alpine high ranges of the Himalayas, provide a wide range of habitat supporting an equally wide range of fauna. Wildlife, which is gradually diminishing in numbers, exists mostly in the forest areas.

44.4.2 The population of wildlife is critical except in national parks, sanctuaries and closed areas. Even in these areas, there are only a few pockets where the animal population can be called optimum. There is enough scope for increasing almost all forms of wildlife so as to bring their numbers to the carrying capacity of the habitat.

Causes of Depletion of Wildlife

44.4.3 Past history shows that wildlife had been destroyed either directly by the rulers and their army or indirectly by ruthless destruc-

* The Expert Committee of the Indian Board for Wildlife in their Report (1970) defines wildlife to mean "the entire native uncultivated flora and fauna of the country". The Wildlife (Protection) Act, 1972 defines wildlife to include "any animal, bees, butterflies, crustacea, fish and moths and aquatic or land vegetation which forms part of any habitat." For the purpose of this section, we have excluded the aquatic and land vegetation.

tion of its habitat. The over-exploitation of forests during the Second World War accelerated destruction of the habitat. The population irruption and the urge to raise the living standards by extensive agriculture, rapid industrialisation, large development of irrigation and power projects, overgrazing, use of insecticides and pesticides, led to a sharp decline in all forms of wildlife, noticeable significantly since World War II. Use of fast moving vehicles, particularly jeeps, for hunting largely compounded the felony. There was a lack of awareness of the economic value of wildlife, and there was no conscious effort to save it from destruction by adopting proper legislative and administrative measures. The activities of the hunters and proliferation of crop protection licences, together with callousness towards the needs of wildlife and its habitat for perpetuation, accelerated the process of decimation. A few forms of wildlife have reached a critical stage of shortly becoming extinct unless immediate remedial measures are taken.

Extinct and Endangered Species

44.4.4 The hunting cheetah is considered extinct in India today. The pygmy hog and the hispid hare which were considered as extinct have been recently discovered in very small numbers in Eastern India. Many important forms of wildlife like the whitewinged wood duck, dugong, wild ass, fishing cat, marbled cat, caracal, clouded leopard, snow leopard, etc. are seriously threatened with extinction. Other important animals like the hoolock, liontailed macaque, nilgiri langur, tiger, red panda, tragopans, cheer pheasant and the great Indian bustard have all become extremely rare. A list of rare and endangered species is given in Appendix 44.1. It is only recently that the export of many of these rare animals has been banned, though protection from hunting for some of these animals is still to be enforced.

Management of Wildlife

44.4.5 The management of wildlife in the forest areas has been with the Forest Departments ever since systematic forestry was commenced in the last part of the nineteenth century. In many of the States, wildlife and its products have been included under the definition of "forest produce", when found in, or brought from, a forest. The rulers framed under the Forest Acts have provided for regulation of hunting by constitution of hunting blocks, observance of close periods, issue of licences, protection of a few important forms and fixation of bag limit in respect of animals allowed for hunting. The

issue of licences or fixation of bag limit did not depend on a scientific appraisal of the availability of game. The fixation of close seasons has also been directly linked with the accessibility of forests and not on the biotic requirements of the game animals. There is no uniformity of game rules, and grant of hunting licences in blocks adjacent to sanctuaries is not uncommon.

44.4.6 A few selected wildlife habitat wherein a preponderance of certain forms of wildlife was observed have been constituted as national parks and sanctuaries. Many of the national parks and sanctuaries were once the popular hunting grounds of the privileged class of rulers and their guests. It is only recently that the selection of areas for national parks and sanctuaries and their extent are being considered on a scientific basis to make them compact eco-units. Many of the sanctuaries and national parks need realignment of boundaries or demarcation of buffer zones to cover the range of movement of the animals therein. The management of sanctuaries where the animals receive protection only from the *shikaris* has been mostly with the Forest Departments. In most cases there is lack of special staff or of systematic training to the staff employed to look after the sanctuaries. Even the development of sanctuaries under the scheme of "Nature conservation" during the five year plans has laid emphasis on improving tourist facilities rather than the needs of wildlife.

44.4.7 The wildlife outside the forest areas has not at all been under any systematic management. Even the provisions of the Forest Acts, and the rules thereunder, did not cover wildlife outside the forest areas. A few States like Karnataka, Maharashtra, Gujarat, West Bengal, etc. had Wild Animals and Birds (Protection) Acts to cover the non-forest areas also, but the impact of such legislation had not been felt because of the lack of appropriate organisation to implement the provisions of the Acts.

44.4.8 The Forest Departments of the major States divide the forest areas outside wildlife sanctuaries into suitable hunting blocks or hunting reserves for which licences are issued during the open season. The licence fees, vary from State to State. Generally there is a licence fee for hunting small game, big game or special big game. Bag limits are prescribed for a few hunting blocks in a few States, whereas there are no bag limits in respect of annual small game licences issued in a few States. The licence fees vary from a meagre Rs. 15 per annum for small game to Rs. 300 for special game or Rs. 500 per annum for a shooting block. A higher rate upto Rs. 3000 is charged for non-residents. In many States exemptions are given to a wide range of VIP's and gazetted officers of the various Departments from obtaining the licence for *shikar*.

44.4.9 The close season varies considerably for birds and animals. In many States the close season commences in June because the forests become inaccessible during monsoons. Generally speaking, the close season does not take into account the biological needs to protect the species. There are some hunting rules like prohibiting use of headlights, shooting on water holes or hunting from a fast moving vehicle, etc. in a few States. Even then rules are observed only in forest areas and there is no control over hunting in non-forest areas.

44.4.10 Although bag limits are fixed in respect of important animals, there have been many cases wherein bag limits have been exceeded in the past. It is also true that the bag limits are not fixed on a systematic appraisal of the total population, carrying capacity of the habitat or the number required to be culled for scientific reasons. The fast decline in the population of game animals is enough to prove that the *shikar* rules have not been effectively served their purpose.

44.4.11 The national forest policy of 1894 did not lay down any directive for wildlife conservation and management. The revised national forest policy of 1952 emphasised "the need for affording protection to the animal kingdom and particularly to rare species such as the lion and the great one-horned rhinoceros, which are fast disappearing..... It is necessary, therefore, that bird and animal life should be controlled by special laws and rare fauna preserved by setting up sanctuaries and large scale national parks".

44.4.12 The Indian Board for Wildlife (IBWL) was set up by the Government of India in 1952 for the following purposes :

- (i) to devise ways and means for the conservation and control of wildlife through coordinated legislative and practical measures with particular reference to seasonal and regional closures, declaration of certain species as protected and prevention of indiscriminate killings ;
- (ii) to sponsor the setting up of sanctuaries, national parks and zoological gardens ;
- (iii) to promote public interest in wildlife and the need for its preservation in harmony with natural and human environments ;
- (iv) to advise Government on policy in respect of the export of living animals, trophies, skins, fur, feathers and other wildlife products ;
- (v) to perform such other functions as are germane to the purpose for which the Board has been constituted ; and
- (vi) to prevent cruelty to birds and animals caught alive with or without injury.

The Board has also constituted four wings for looking into the problems of management of (a) zoos, (b) birds, (c) fisheries, and (d) flora.

The executive committee of the IBWL meets once in a quarter to review the action taken on its recommendations. An Expert Committee of the IBWL made a comprehensive study of conservation problems in 1970. Another Expert Committee was set up by the IBWL to examine the zoo management and it has submitted its Report in 1975.

44.4.13 The Wildlife (Protection) Act, 1972 was passed by Parliament under Clause (1) of Article 252 of the Constitution. This Act governs wildlife conservation and protection of endangered species both inside and outside the forest areas. As of April 1975, the Act has been adopted by all States except Assam, Nagaland and Jammu and Kashmir.

44.4.14 The serious position in the depletion of tigers in the country was taken note of and tiger shooting has been prohibited throughout the country. The Government of India has also initiated since 1973-74 a project known as 'Project Tiger' for giving special attention to the conservation of the tiger. The areas selected are :

- (i) Manas Wildlife Sanctuary (Assam).
- (ii) Palamau Wildlife Sanctuary (Bihar).
- (iii) Bandipur—Mudumalai Complex (Karnataka—Tamil Nadu).
- (iv) Simlipal Hills (Orissa).
- (v) Kanha National Park (Madhya Pradesh).
- (vi) Melghat area (Maharashtra).
- (vii) Ranthambore Wildlife Sanctuary (Rajasthan).
- (viii) Corbet National Park (Uttar Pradesh).
- (ix) Sunderbans (West Bengal).

44.4.15 At the Centre, the Inspector General of Forests, Ministry of Agriculture and Irrigation, maintains contacts with the States with regard to implementation of the policies recommended by the IBWL. He is assisted by a Deputy IGF (presently in abeyance), Deputy Secretary, Forests and Wildlife who is also Director of Wildlife Preservation under the 1972 Act and acts as the Member Secretary of IBWL, and an Assistant IGF. A Director for implementation of the Project Tiger has also been appointed in the Ministry.

44.4.16 In most States, the wildlife administration is with the Forest Departments. A few States like Uttar Pradesh, West Bengal, Karnataka, Rajasthan, Madhya Pradesh, Orissa, Jammu and Kashmir and Gujarat have State level officer to head the wildlife organisation. In these States, there are a few Deputy and Assistant Conservators of Forests and protective staff to look after the wildlife sanctuaries. In leading wildlife sanctuaries, some subordinate staff has been provided to receive and cater to the needs of the tourists. A proper network of wildlife management staff outside the sanctuaries has not

been appointed in most States though the IBWL has recommended to this effect. There is no administrative set-up in most States to implement the provisions of the wild birds and animals protection Acts in non-forest areas. The Wildlife (Protection) Act 1972 provides for the appointment of a number of wildlife protection staff with powers and functions to implement the provisions of the Act all over the States covering forest, non-forest and urban areas.

44.4.17 A Senior Research Officer (Wildlife) has been appointed in the FRI, but he is fully occupied in conducting a wildlife management training course for the in-service personnel. The World Wildlife Fund and the Bombay Natural History Society have promoted and collaborated in selected wildlife research studies like bird migration, habitat of the swamp deer in Kanha National Park, habitat of the lion in Gir Sanctuary, etc. The tendency of foreign universities or research organisations has been to utilise the rich virgin fields of tropical wildlife in this country to train and build up a cadre of research workers useful to their countries and not necessarily to conduct research for betterment of wildlife management in this country. The IBWL has recently resolved to appoint an Expert Panel in the Ministry of Agriculture and Irrigation to screen the research projects and decide about the future research policy in wildlife.

44.4.18 A wildlife management course for selected in-service personnel of the Forest and other Departments of the States has been opened in the FRI. The FRI has already turned out six batches of trainees in a curriculum now covering 10½ months including visits to field areas. There is a proposal to commence a brief popular course for the benefit of Departments interested in wildlife and allied subjects. Besides the Senior Research Officer (Wildlife), there is no teaching staff for the wildlife training course at the FRI.

44.4.19 Wildlife publicity is confined to the celebration of wildlife week during October every year. The celebrations include radio and television programmes, issue of posters and pamphlets, administering the wildlife pledge at public functions, encouragement to visit zoos and sanctuaries and shows of wildlife films in selected towns and cities. The wildlife week celebrations are becoming an annual ritual without much impact on the rural masses. A few States have made rules to compensate for the loss of the villagers' crops by destructive wild animals like elephant and loss to their cattle by carnivora in the sanctuaries. This step alone has failed to obtain the sympathy of the villagers to the cause of wildlife, and they have not realised the importance of wildlife. Cases of killing carnivora by use of folidol or some other poison on the kill are not uncommon.

Suggestions for Future Management

44.4.20 Within a well protected habitat, wildlife by proper management becomes a valuable natural resource conferring manifold benefits on mankind, accruing from consumptive as well as non-consumptive uses. The consumptive uses are sport, hunting, food, hides, horns, bones, etc. The non-consumptive uses are scientific, recreational, aesthetic, cultural, educational and ecological. The overall values of wildlife may also be classified as (a) productive values such as a source of supply of proteins, source of revenue from tourism and from recreational facilities, pool of potential reserve material for breeding and agent for pollination; and (b) cultural values such as recreation, education, study of natural history, and improvement in the beauty of landscape.

44.4.21 The wildlife of the country has to be considered in the context of its habitat, and its protection and management have to be done within the framework of habitat management. The object should be to have as large a population and as varied a composition of wildlife as is compatible with the carrying capacity of the habitat and with other land-use. Policy for management of wildlife should take into account the endangered or depleted species and those which are of potential economic benefit. Differing management prescriptions would be required for these two categories.

44.4.22 An essential step would be the tying up of loose ends in wildlife legislation. The remaining few States should be persuaded to adopt the Wildlife (Protection) Act, 1972. A provision exists in the Act for constituting State Wildlife Advisory Boards for advising State Governments in certain matters. Similarly, there should be a provision in that Act for constituting the IBWL, with adequate representation of State Boards in the IBWL. The scope of the functions of the IBWL should be enlarged to include such responsibilities as collection of scientific literature, dissemination of scientific knowledge and maintenance of liaison with the organisations dealing with nature conservation in the country and abroad.

44.4.23 The Report (1970) of the Expert Committee of the IBWL distinguishes four kinds of natural areas: (a) national parks, (b) sanctuaries, (c) nature preserves, and (d) game reserves. The Wildlife (Protection) Act, 1972 includes provisions for creating and managing (a) national parks, (b) sanctuaries, (c) game reserves, and (d) closed areas. All the above natural wildlife areas are parts of the forests wherein management of the twin resources of flora and fauna has to be coordinated to maximise the benefits to the community. To coordinate forest management with management of wildlife areas, it is

desirable that forest working plans recognise the conservation and scientific management of wildlife in all forest areas as one of the general objectives of management. To the natural areas must be added the agro-ecosystems and wetlands, which too have got a wildlife population and must be considered in the context of wildlife protection. There would be 'artificial' wildlife areas also, i.e. zoological parks and deer or safari parks, opened in or near urban areas.

44.4.24 The total number of national parks and sanctuaries in India is 5 and 126 respectively and 40 new areas are proposed to be closed to shooting. The total area of the existing units, except eight for which figures are not available, is 23,769 sq. km. In Chapter 41 on Forest Policy, we have recommended: "A core area of about 4 per cent of the forest lands in diverse ecological associations should be dedicated to the principal use of nature and wildlife conservation; where only the forces of Nature would have their say". There are no wildlife preservation areas in four of the sixteen major forest types, i.e. (a) montane wet temperate forests, (b) sub-tropical broad-leaved hill forests, (c) Himalayan dry temperate forests, and (d) sub-tropical dry evergreen forests. It is necessary that the coverage of wildlife preservation areas (national parks and sanctuaries) is extended to these four forest types also. The main considerations in starting a new national park or sanctuary should be the existing forest management pattern, richness of fauna, sufficiency of available area, habitat diversity, existence of a number of ponds, rivers and grassy glades and absence of human interference. The IBWL and the State Wildlife Advisory Boards should guide the selection of such areas for constitution of national parks and sanctuaries.

44.4.25 The boundaries of the national parks and sanctuaries should have sufficient buffer zones to cover the range of movement of wildlife in these areas. There should be a strict protection from fire in national parks and sanctuaries. Grazing and collection of forest produce should be prohibited in the core areas. Habitat manipulation and management should aim at providing maximum facilities and protection to the local fauna so as to raise the population density to maximum carrying capacity of the habitat. The predators and the prey, the herbivores and the herbage should maintain a natural balance between each other. The management should aim at achieving the above objective.

44.4.26 The game areas outside national parks and sanctuaries should be maintained for sport. They should be divided into convenient shooting blocks or shooting reserves depending on availability of game, availability of proper cover and mode of escape to the wildlife, lines of communication, etc. Availability of all forms of wildlife

in each shooting block should be assessed periodically so that game in excess of an optimum genetically viable number may be fixed for cropping. The bag limits prescribed for each kind should always err on the safe side of the above number. There should be uniformity with regard to game rules and regulations at least in contiguous blocks of forests if not over the whole country. The close season should be uniform as far as possible. The reproductive biology of the game animals should be taken into account for fixing the close season. Since there has been a great decline in the number of big game, it is necessary to bring them under the list of protected animals for at least five years and their exploitation should be only for scientific purposes. All the species threatened with extinction, as listed in Appendix 44.1, should be included in Schedule I of the 1972 Act. Since the States are looking forward to the Central Government for the supply of model rules under the Wildlife (Protection) Act 1972, it should be possible to draft model rules to cover hunting regulations, payment of fees, submission of returns, fixation of bag limits, etc. The practice of exempting a large number of VIP's and officials from the procurement of game licences is obsolete. No free licences should be issued. The declaration and destruction of man-eaters and rogues should always rest with the Chief Wildlife Warden of the State and not with any other officer.

44.4.27 There were cases of illicit hunting by the defence personnel and security forces stationed in border areas in the desert and high mountainous tracts. The IBWL considered the issue, and as decided the Chairman of the IBWL has written to the authorities concerned to strictly observe the wildlife protection laws and rules in force. This step is in the right direction. The IBWL has also recommended that local Army Commanders should be invited to be members of the State Wildlife Advisory Boards, to ensure their cooperation in preserving wildlife.

44.4.28 So far as management of forests is concerned, the sequence and arrangement of areas taken up for regeneration feelings should be such that they proceed from the fringe towards the heart of the forests, so that inner abode of wildlife in the depth of the forest is well-guarded and wildlife does not spill over to a vulnerable area when its most protected haunt is disturbed. This can be done by proper alignment of cutting sections. The coupes should be rectangular to provide greater edges which result in better utilisation of newly produced food by herbivores. In case of areas to be clearfelled, standing forest should be retained on the strips on the banks of water-courses, and a few mature trees with spreading crowns should be left to give shelter and nesting place for birds. In selection forests shorter felling cycles should be preferred to longer ones so that the intensity

of feelings is not high. When silvicultural considerations demand a heavy top canopy opening, due protection to middle storey and undergrowth should be given. When thinnings in all the layers of forests is necessary on silvicultural considerations, the thinned areas should be staggered with unthinned ones and annual thinning coupes should be relatively small in extent by use of cutting sections. When wild animals interfere with regeneration and their exclusion from any area is essential, suitable fencing can be erected and the licenced shooting can be concentrated in such regeneration areas and disallowed over the rest. Thus the accumulated wild animal increment would be harvested from regeneration areas and the wildlife elsewhere in the working circle would be conserved as growing stock. However, harvesting of wild animals should be considered on a long-term basis at least for the coming few years.

44.4.29 In our Interim Report on Production Forestry—Man-made Forests, transfer of forest areas to forest corporations has been envisaged. The status of wildlife in such areas needs to be clarified. We would suggest that the corporations should be responsible for development and management of wildlife in areas under their control. Requisite number of special staff should be employed by them. Environmental considerations should also guide the corporations' working of the forests. In the Interim Report, we have urged that forest corporations should make investments for setting up of recreation centres.

Administration

44.4.30 There is a view that the ideal organisation would be to place under one administration all authority for protection, regulation and use of wildlife on land and water. For advice and support, an advisory board could be constituted with representatives of all interests¹. The IBWL has recommended that for administration, management and conservation of wildlife the State Governments should establish a separate wildlife wing in the Forest Departments directly under the Chief Conservators of Forests. We concur with the recommendation of the IBWL, as we are of the view that the management of fauna cannot be differentiated from that of flora under Indian conditions. Protection of the habitat is as much a problem in this country as scientific development and use of wildlife and hence a separation of authority would so dilute the responsibility as to be a great hindrance to wildlife development.

¹ 1969 (Nov). Proceedings of the Commission on Education of the International Union for the Conservation of Nature, held at FRI, Dehra Dun.

44.4.31 For coordination at the Centre, an adequate Central organisation is necessary. We are of the view that there should be a division of wildlife under the Inspector General of Forests (IGF), headed by an officer of the rank of Additional IGF. He should be assisted by three Directors in the rank of Deputy IGF. One of the Directors would be for implementation of Wildlife (Preservation) Act 1972, as provided for in the Act, and he should be the secretary to the IBWL. The second Director would be entrusted with the aspects of tourism based on wildlife and national parks (elaborated in Section 6 of this chapter). The third Director would be for special projects, like Project Tiger, wildlife census, etc.

44.4.32 In the States, the wildlife wings should be headed by an officer in the rank of Additional Chief Conservator of Forests or Conservator of Forests, depending on the area of the State and varieties in ecological, faunal, floral, geomorphological or zoological situations within the State. He should be the Chief Wildlife Warden for the purposes of the Act and secretary to the State Wildlife Advisory Boards. The personnel in the wildlife wing of the forest Services should directly manage the national parks and sanctuaries. It is emphasised that in management of such parks and sanctuaries dual control by having a separate territorial staff or officer with overlapping wildlife staff should be eliminated. In the rest of the forest areas, the responsibility of wildlife management should rest squarely on the territorial staff. The wildlife wing should assist in preparing the wildlife management plans for these areas as a part of the working plans or project plans. It is imperative that horizontal movement to and from the wing is permitted. The forest corporations should also obtain their requirement of staff for development of wildlife and recreation in areas transferred to them from the wildlife wing.

44.4.33 The most serious administrative shortcoming is with regard to areas outside the Forest Departments' control. Due to lack of staff, wildlife in many such areas has dwindled appreciably. The situation is particularly acute in the case of wetlands (cf. paragraph 44.3.5) and the arid areas. The strength of the wildlife wing in each State should be adequately built up for effective wildlife conservation in areas inside and outside the forests. It may also be mentioned that there are some areas outside the forests round the villages of certain communities, where certain flora and fauna are considered sacred and protected by the villagers. Unfortunately even in these areas, it is becoming difficult for the local people to preserve the flora and fauna. The organisation that they may be set up under the 1972 Act should enlist the cooperation of such villagers and render them necessary assistance for protection of wildlife. Near the existing and the new urban areas, special measures should be taken to see

that the wildlife is not destroyed by illegal hunting through fast moving vehicles and artificial light.

Public Relations

44.4.34 There should be a strong publicity machinery to produce popular literature and audio-visual material for free distribution and display in educational institutions and rural congregations to ensure that the awareness of the importance and values of wildlife is imbibed by the masses. Encouragement to the people by awarding public recognition or by rewards for detection of smuggling and poaching and encouraging voluntary efforts at Nature conservation are also needed. The local bodies like the *panchayats* should be actively involved in wildlife conservation movements.

Finance

44.4.35 The State forest Departments did not spend any money separately for wildlife administration before the Independence. With the constitution of many sanctuaries and national parks coupled with the importance given to the 'Nature Conservation' scheme in the five year plans, some allocations were made during the Second, Third and Fourth Plans. The allocations were mostly based on projects aimed at improving selected national parks and sanctuaries for promotion of tourism on an *ad hoc* basis. The expenditure incurred under the scheme of 'Nature Conservation' has been Rs. 99.52 lakhs during the Second Plan, Rs. 175.07 lakhs during the Third Plan, and Rs. 313.70 lakhs upto the end of 1972-73 in the Fourth Plan. There have not been any Central schemes for Nature conservation during the past five year plans, except Delhi Zoological Park which received at Rs. 56.20 lakhs in the Second Plan, Rs. 34.67 lakhs in the Third Plan and Rs. 25 lakhs in the Fourth Plan. The proposed outlay in the State sector during the Fifth Plan is Rs. 11 crores for wildlife and constitution of Nature reserves. In addition, to assist selected national parks and sanctuaries, the proposed outlay under a Centrally sponsored scheme is Rs. 2.5 crores during the Fifth Plan. The Delhi Zoological Park is expected to receive Rs. 60 lakhs during the Fifth Plan.

44.4.36 It is essential that master plans to cover at least 10 years are prepared for wildlife management, including development of national parks, sanctuaries, etc., and the plan allocations on need-based priorities channelised to the schemes so drawn up. It would also be worthwhile to raise trusts by taking donations for financing selected projects of national importance like the Project Tiger and similar

projects aimed at conservation of selected species likely to become extinct.

Wildlife Research and Education

44.4.37 Research has been done in developed countries on the quantification of tangible and intangible benefits of wildlife. It should be a long term goal of ecological research in this country to develop models suitable for different types of forest ecosystems which have the highest overall productivity and which yield the highest economic returns, tangible as well as intangible, in terms wood, wildlife and other products consistent with environmental conservation. In Chapter 46 on Forest Planning, Research and Education, we have indicated a few problems of research on forest ecology, including wildlife. We have stated that research on wildlife need not be institutionalised but be mainly done through independent projects undertaken by competent workers. In wildlife research, more than in any other discipline, such an approach appears to be the most appropriate. The Council of Forest Research and Education (CFRE), the setting up of which we have recommended in our Interim Report on Forest Research and Education, should be able to identify suitable projects and sites for research on wildlife. It should select suitable forestry personnel or outside specialists for entrusting them with specific research projects. However, there would be need to monitor and coordinate as well as provide laboratory facilities to workers in the field so selected. There would also be need to carry out routine studies on census, mortality, diseases, etc. on a regular basis. For this purpose the CFRE should set up a strong research cell in the FRI, and in each State there should be adequate wildlife research personnel included in the wildlife wing of the forest Services.

44.4.38 Education on the role of forests in environmental conservation depends upon several factors. Firstly, there is the question of proper public instruction on environmental pollution, the role of forests in conserving the environment and on the compatibility of production forestry and wildlife management with the conservation of environment. Towards this end the help of spoken and visual media, community centres and village teachers, etc. should be enlisted, and popular literature, journals and magazines devoted towards environmental role of forests should be published. Symposia, seminars, workshops and debates on the subject should also be organised.

44.4.39 Secondly, there is the question of environmental education at the school and college levels. The importance of giving an orientation towards environmental conservation to academic curricula and syllabi in all States can hardly be over-emphasised. The Union

Education Ministry should urge upon all the State Education Departments the necessity of giving such orientation. The syllabi in biology, physics, chemistry, geography, social sciences and other related disciplines have scope for incorporating environmentalist ideas and the boards revising the syllabi should be asked to make modifications accordingly. The Central Board of Secondary Education has already taken the lead in incorporating some features of conservation of natural resources in their revised syllabus coming in force from 1975-76. Approval of text-books on these subjects should be made conditional to their covering this added parts of the syllabi adequately. Audio-visual aids like charts and films should be made available. A core of teachers should be trained through short lecture courses in environmental concepts to train further batches of teachers. Some incentives should be developed by the appropriate managing bodies of schools for teachers participating in in-service environmental training. Symposia, seminars, workshops and other training activities for teachers imparting environmental education should be held. For students, outdoor and extra-curricular activities to acquaint them with the dangers of environmental pollution and the necessity of conserving the quality of environment should be organised. Organisations such as Friends of Trees, Friends of Wild Animals, Young Naturalists' Societies, Youth Hostels Associations, etc., should be encouraged. A balanced outlook towards the environmental problems with regard to the level of economic and industrial development and future needs should be developed through all these efforts.

44.4.40 Thirdly, at the university stage there is need for environmental education and training of a higher order. The University Grants Commission had appointed as expert committee to go into the question of environmental education in the universities. A proposal for starting an Institute of Environmental and Ecological Sciences, though by and large approved by the committee, could not be implemented due to financial constraints. Post-graduate interdisciplinary courses of study for vocations in the field of natural resources, such as M.Sc. courses in environmental sciences and natural resources, should, however, be opened in more and more universities. The Banaras Hindu University has already got a course of M.Sc. in Resource Ecology. Tamil Nadu Agricultural University has inaugurated in September 1975 and M.Sc. degree programme in Environmental Biology. It should be ensured that teachers' training and education courses in the universities have a content of environmental conservation. Universities should ensure greater communication mutually and with foreign institutes, specially through the media of UN, UNESCO, FAO, IUCN, MAB, etc., on environmental conservation.

44.4.41 Lastly, comes the question of environmental training in professional training institutions. All the professional training institutes dealing with land-use, e.g. agricultural universities, should include in their training programme a course of lectures on environmental conservation. Institutes for training in general administration, forestry, agriculture, animal husbandry, fishery, horticulture, civil engineering, architecture, mining and oil exploration should be included in the list of such institutions, besides any others where the training is relevant to the profession. The course of lectures should be tailored to the needs of the particular profession. Visiting experts from other institutes and universities should be invited where the teaching faculties do not have facilities for running such courses. The FRI can be called upon to provide lectures dealing with the role of forestry and wildlife in environmental conservation.

44.4.42 So far as the in-service education and training for the different forest Services is concerned, we have elaborated our concept in Chapter 46 on Forest Planning, Research and Education. For the higher forest Services, we have suggested an optional advanced course on wildlife and environment in the Indian Forest College. We have also suggested a similar arrangement in the in-service education and training for the Forest Rangers. In addition, the FRI at present runs a short course on wildlife, but due to inadequate staff complement it has not been found possible to cover the course fully as per syllabus, which is necessarily a comprehensive one. The staff should be suitably augmented, and we suggest that three lectures would be the barest minimum besides the supporting staff. However, when the research cell is built up in the FRI (cf. paragraph 44.4.37), the researchers should conduct the training course. Short courses on wildlife and environment should be devised for all levels of forestry personnel and suitable arrangements should be made in the State as well as national institutions for imparting training in these courses. It is recommended that undergoing such short courses should be compulsory for the personnel to be inducted in the wildlife wing of the forest Services.

5 DISEASES OF WILDLIFE

44.5.1 Diseases are one of the major decimating factors causing mortality among wild animals. Epidemics of viral and bacterial origin have, in distant and recent past, caused great losses in the Indian wildlife, particularly among the herbivores. Whereas considerable work has been carried out on diseases occurring in domestic livestock in the country, almost nothing has been done so far in case of wild

animals. Epidemics in wildlife have been of frequent occurrence but most of them have gone unrecorded, and the accounts of even those which have been described are rather sketchy. It is unfortunate that even the recent outbreaks of rinderpest in South India during 1968 and 1975 which wiped out a very large population of Indian bison (*Bos gaurus* H. Smith) and of haemorrhagic septicaemia in Sariska (Rajasthan) which caused heavy mortality among *sambhar* (*Cervus unicolor* Kerr) and *nilgai* (*Boselaphus tragocamelus* Pallas) in 1970-71 have not been properly investigated. From the available information, it appears that the most widespread epidemics among wildlife have been caused by rinderpest, foot-and-mouth disease, anthrax and haemorrhagic septicaemia.

44.5.2 There is great inadequacy in the methods of detection and prophylactic treatment of diseases among wild animals. Adequate attention to prevention of diseases in wildlife is highly necessary not only to ensure the health of the wild species of the animals but also to safeguard against the spread of infectious agents to domestic livestock. We have already made a mention* of such eventualities in Chapter 35 on Animal Health. In our opinion, it is highly important to conduct a survey of major diseases affecting wildlife and to devise suitable preventive measures. The importance of stress in causing or accentuating disease conditions among wildlife also needs investigation. We recommend that studies on these aspects may be organised by the CFRE in collaboration with the Indian Veterinary Research Institute and the agricultural universities. Further, a couple of experienced veterinarians in each State Veterinary Department should be trained in diagnosis and prophylactic treatment of diseases among wildlife and they should be made available to forest authorities, whenever required. Every national park/sanctuary should employ qualified veterinary staff to look after the work of prevention and treatment of diseases of wildlife and should be provided with dart guns and adequate stock of sedatives and tranquilisers so that diseased wild animals could be isolated. The forest officers concerned with wildlife management should be trained for a short period of 3-4 weeks to acquaint themselves with the aetiology and symptomatology of the commonly occurring infectious diseases of wildlife.

44.5.3 We have given a list (Appendix 44.1) of the Indian wild animals that have become rare and whose multiplication in captivity will be a valuable insurance against their total extinction. The zoos/zoological parks will have to play a great role in breeding such rare animals for the purpose of their release in wildlife areas. In view of

* In paragraph 35.5.5 we have stated that all cattle and buffaloes going into the forests for grazing should be vaccinated at the forest checkposts.

the great importance of keeping the animals in the zoos/zoological parks under good conditions of health and to protect them from diseases, it is necessary to carry out a systematic survey of the commonly occurring infectious and deficiency diseases among wild animals in captivity and to devise suitable preventive measures and curative treatment. We recommend that these studies may be organised by the CFRE in collaboration with the Indian Veterinary Research Institute and the agricultural universities.

6 WILDLIFE AND TOURISM

44.6.1 The significance of tourism in the economy of developing country like India cannot be overstated. For not only does it help to bring in much needed foreign exchange but it also creates new jobs and helps in reducing unemployment. Being a highly service oriented and labour intensive industry the major part of money spent by the tourist gets reinvested in the national economy. In contrast to other industries tourism does not earn foreign exchange by exporting national wealth. The tourism sector is a very worthwhile area for investment, and profitability from it should be seen in terms of total overall socio-economic benefit to the country and not in terms of profitability of individual projects particularly in their early stages.

44.6.2 Hitherto the emphasis in India had been on development of tourism based on its historical and cultural assets. To this recently a new dimension has been added, that of wildlife tourism. It has a great potential but needs to be handled with care. As population, income, leisure and availability of rapid transport facilities grow, there will be greater and greater demand on the natural environment to provide for the recreational needs of the people.

44.6.3 The countries of East Africa have amply demonstrated the importance of developing tourism related to wildlife and natural environment. In all this development it has however to be borne in mind that the natural areas being developed are not spoiled by over-visitation beyond their carrying capacity and that development has to be so carried out so as to blend harmoniously with the surrounding natural environment.

44.6.4 During the Fourth Plan, a total allocation of Rs. 60.20 lakhs was made for wildlife tourism. This was utilised for augmenting tourist accommodation and transportation for viewing wildlife in selected national parks/wildlife sanctuaries in the country, and for financial assistance for creating safari parks at Hyderabad and at Borivili near Bombay.

44.6.5 Thus a beginning in development of wildlife tourism has been made in the country. If, however, wildlife tourism is to be developed properly, a comprehensive and massive developmental effort is really called for. Development of a few selected national parks and wildlife sanctuaries, such as Kaziranga (Assam), Bharatpur (Rajasthan), Gir (Gujarat), Periyar (Kerala), Sariska (Rajasthan), Sultanpur (Haryana) and Dachigam (Jammu & Kashmir), should be undertaken. More national parks should be set up in special category areas, e.g. marine, mountain and desert, to effectively preserve and display the typical habitat of these areas and their characteristic fauna and flora for the purpose of tourism and research. Efforts should be made to develop zoological parks, safari parks, sports fishing (fresh water and marine), wildlife publicity, etc., and to promote special interest tours like bird watching, trekking, etc.

44.6.6 It is important that in the context of the situation in India, the State authorities have to be actively involved in wildlife tourism development effort. This is particularly relevant as wildlife is a State subject. This issue was discussed in depth at the XV Meeting of the Tourist Development Council and comprehensive resolutions were also adopted for implementation by the concerned authorities (Appendix 44.2).

7 SUMMARY OF RECOMMENDATIONS

44.7.1 The more important recommendations made in this chapter are given below :

1. The coverage of preservation plots should be increased to attain a fair percentage of all the recognised subtypes.

(Paragraph 44.3.3)

2. A list of protected trees in the country should be prepared by the Forest Research Institute, Dehra Dun (FRI) and deficiencies discovered regarding coverage of important species should be made good by joint action of the State Forest Departments and the FRI.

(Paragraph 44.3.3)

3. The Forest Department should demarcate a few Nature reserves to preserve forest areas and wetlands under virgin or near virgin conditions.

(Paragraph 44.3.5)

4. Where coppice systems are adopted, environmental considerations should be carefully balanced with silvicultural considerations and convenience of working.

(Paragraph 44.3.13)

5. In the man-made forestry programme, safeguard against likely environmental ill effects should be taken by a correct identification of the programme area.

(Paragraph 44.3.17)

6. It should be possible to plant up in multiple rows the strips on the sides of roads, canals and railway lines for creating better aesthetic effects along with meeting other demands through extension forestry on such lands. Whenever the highways pass through some interesting landscape planting should be adjusted with suitable gaps to make viewing possible. *Ficus* trees, *neem*, etc., should be introduced along with other quick growing species, so that these trees can provide food to the birds, which would otherwise descend on the cultivated fields.

(Paragraphs 44.2.6 and
44.3.20 to 44.3.24)

7. Recreation forests should be developed with aesthetic considerations, and alignment and specification of the roads and paths should be made with the idea of creating and maintaining natural forest character.

(Paragraphs 44.3.28 and 44.3.29)

8. The structures in the forest should be so planned that aesthetics are preserved. The design and siting of all structures in national parks, wildlife sanctuaries and Nature reserves should be put up for approval by the Indian Board of Wildlife (IBWL) or the State Wildlife Advisory Boards concerned. In particular, care should be taken not to create multistoreyed or large concrete structures that do not merge well with the surrounding forests. In other forest areas, the Forest Departments should generally follow the trends set by the Wildlife Boards.

(Paragraph 44.3.31)

9. All private advertisement hoardings in the forests should be prohibited, and the signboards of plantation etc. should be small, inconspicuous and so fixed as not to obstruct the natural features.

(Paragraph 44.3.32)

10. The object of habitat management for wildlife should be to have as large a population and as varied a composition as is compatible with the carrying capacity of the habitat. To coordinate forest management with that of wildlife areas, the forest working plans should recognise the conservation and scientific management of wildlife in all forest areas as one of the general objectives of management.

(Paragraphs 44.4.21 and 44.4.23)

11. The States which have not adopted the Wildlife (Protection) Act 1972 should be persuaded to do so.

(Paragraph 44.4.22)

12. There should be a provision in the 1972 Act for constituting the IBWL, with adequate representation of the State Wildlife Advisory Boards in the IBWL. The scope of the functions of the IBWL should be enlarged.

(Paragraph 44.4.22)

13. The coverage of wildlife preservation areas (national parks and sanctuaries) should also be extended to the following four major forest types, where there are no wildlife preservation areas at present: (a) montane wet temperate forests, (b) sub-tropical broad-leaved hill forests, (c) Himalayan dry temperate forests, and (d) sub-tropical dry evergreen forests.

(Paragraph 44.4.24)

14. The boundaries of the national parks and sanctuaries should have sufficient buffer zones to cover the range of movement of wildlife in these areas. Grazing and collection of forest produce should be prohibited in the core areas. Habitat manipulation should aim at providing maximum facilities and protection to the local fauna so as to raise the population density to the maximum carrying capacity.

(Paragraph 44.4.25)

15. The game areas outside national parks and sanctuaries should be divided into convenient shooting blocks or shooting reserves depending on availability of games, etc. Availability of all forms of wildlife in each shooting block should be assessed periodically so that game in excess of an optimum genetically viable number may be fixed for cropping. The bag limits prescribed for each kind should always err on the safe side of the above number.

(Paragraph 44.4.26)

16. There should be uniformity with regard to game rules and regulations at least in contiguous blocks of forests if not over the whole country. The close season should be uniform as far as possible, and the reproductive biology of the game animals should be taken into account for fixing the close season. Model rules should be drafted by the Central Government to cover hunting regulations, Payment of fees, etc.

(Paragraph 44.4.26)

17. All the species threatened with extinction, as listed in Appendix 44.1, should be included in Schedule I of the 1972 Act. In the case of big game, they should be brought under the list of protected animals for at least 5 years and their exploitation should be only for scientific purposes.

(Paragraph 44.4.26)

18. In the management of forests, the sequence and arrangement of areas taken up for regeneration fellings should be such that they proceed from the fringe towards the heart of the forest.

(Paragraph 44.4.28)

19. The State forest corporations should be responsible for development and management of wildlife in areas transferred to their control. Environmental considerations should also guide the corporations' working of the forests. Their requirement of staff for development of wildlife and recreation should be obtained from the wildlife wing of the forest Services.

(Paragraphs 44.4.29 and 44.4.32)

20. For administration, management and conservation of wildlife the State Governments should establish a separate wildlife wing in the Forest Departments directly under the Chief Conservators of Forests as recommended by the IBWL. The strength of the wildlife wing in each State should be adequately built up for effective wildlife conservation in areas inside and outside the forests.

(Paragraphs 44.4.30 and 44.4.33)

21. There should be a Division of Wildlife under the Inspector General of Forests, headed by an officer of the rank of Additional IGF, who should be assisted by three Directors in the rank of Deputy IGF.

(Paragraph 44.4.31)

22. The personnel in the wildlife wing should directly manage the national parks and sanctuaries, and dual control by having a separate territorial staff or officer with overlapping wildlife staff should be eliminated. In the rest of the forest areas, the territorial staff should be responsible for wildlife management.

(Paragraph 44.4.32)

23. There should be a strong publicity machinery to produce popular literature and audio-visual material on wildlife for free distribution and display in educational institutions and rural congregations. The help of spoken and visual media, community centre and village teachers etc. should be enlisted; and popular literature journals and magazines devoted towards environmental role of forests should be published. The local bodies, like the *panchayats* should be actively involved in wildlife conservation movements.

(Paragraphs 44.4.34 and 44.4.38)

24. Master plans to cover at least 10 years should be prepared for wildlife management, including development of national parks, sanctuaries, etc. and the plan allocations channelised on need-based priorities to the schemes so drawn up. It would also be worthwhile

to raise trust by taking donations for financing selected projects of national importance aimed at conservation of selected species likely to become extinct.

(Paragraph 44.4.36)

25. The Council of Forest Research and Education (CFRE) should select suitable forestry personnel or outside specialists for entrusting them with specific wildlife research projects. The CFRE should set up a strong research cell in the FRI, and in each State there should be adequate wildlife research personnel.

(Paragraph 44.4.37)

26. The syllabi in biology, physics, chemistry, geography, social sciences and other related disciplines should be suitably modified for incorporating environmentalist ideas. A core of teachers should be trained through short lecture courses in environmental concepts to train further batches of teachers.

(Paragraph 44.4.39)

27. Post-graduate interdisciplinary courses of study for vocations in the field of natural resources should be opened in more and more universities.

(Paragraph 44.4.40)

28. All the professional training institutes dealing with land-use, e.g. agricultural universities etc., should include in their training programme a course of lectures on environmental conservation. Visiting experts from other institutes and universities should be invited where the teaching faculties do not have the facilities for running such courses. The Forest Research Institute & Colleges, Dehra Dun can be called upon to provide lectures dealing with the role of forestry and wildlife in environmental conservation.

(Paragraph 44.4.41)

29. Short courses on wildlife and environment should be devised for all levels of forestry personnel. Undergoing such short courses should be compulsory for the personnel to be inducted in the wildlife wing. The staff for this purpose in the FRI should be suitably augmented.

(Paragraph 44.4.42)

30. The CFRE should organise in collaboration with the Indian Veterinary Research Institute (IVRI) and the agricultural universities a survey on major diseases affecting wildlife for devising preventive measures, and an investigation on the importance of stress in causing or accentuating disease conditions among wildlife.

(Paragraph 44.5.2)

31. Experienced veterinarians in each State Veterinary Department should be trained in diagnosis and prophylactic treatment of diseases among wildlife and they should be made available to forest

authorities, whenever required. Every national park/sanctuary should employ qualified veterinary staff to look after the work of prevention and treatment of diseases of wildlife.

(Paragraph 44.5.2)

32. The forest officers concerned with wildlife management should be trained for a short period in the aetiology and symptomatology of the commonly occurring infectious diseases of wildlife.

(Paragraph 44.5.2)

33. A systematic survey of the commonly occurring infectious and deficiency diseases among wild animals in captivity should be organised by the CFRE in collaboration with the IVRI and the agricultural universities, for devising suitable preventive measures and curative treatment.

(Paragraph 44.5.3)

34. For developing wildlife tourism, a few selected national parks and sanctuaries should be taken up for development. More national parks should be set up in special category areas, e.g. marine, mountain and desert, to effectively preserve and display the typical habitat of these areas and their characteristic fauna and flora for the purpose of tourism and research. The State authorities should be actively involved in wildlife tourism development effort.

(Paragraphs 44.6.5 and 44.6.6)

APPENDIX 44.1

(Paragraph 44.4.4)

List of Wildlife Threatened with Extinction in India¹

MAMMALS

1. Ass, Indian Wild (*Equus hemionus khur* Lesson)
2. Ass, Tibetan Wild or Kiang (*Equus hemionus kiang* Moorcroft)
3. Bear, Sloth (*Melursus ursinus* Shaw)
4. Bharal (*Pseudois nayaur* Hodgson)
5. Binturong (*Arctictis binturong* Raffles)
6. Blackbuck (*Antelope cervicapra* Linnaeus)
7. Buffalo, Wild (*Bubalus bubalis* Linnaeus)
8. Caracal (*Felis caracal* Schreber)
9. Cat, Fishing (*Felis viverrina* Bennett)
10. Cat, Golden (*Felis temmincki* Vigors and Horsfield)
11. Cat, Marbled (*Felis marmorata* Martin)
12. Cat, Pallas's (*Felis manul* Pallas)
13. Cat, Rustyspotted (*Felis rubiginosa* Geoffroy)
14. Chinkara (*Gazella gazella* Pallas)
15. Deer, Brow-antlered or Thamin (*Cervus eldi* McClelland)
16. Deer, Musk (*Moschus moschiferus* Linnaeus)
17. Deer, Swamp (*Cervus duvauceli branderi* Pocock)
18. Dugong (*Dugong dugon* Muller)
19. Hare, Hispid (*Caprolagus hispidus* Pearson)
20. Hog-Badger (*Arctonyx collaris* F. Cuvier)
21. Hog, Pygmy (*Sus salvanius* Hodgson)
22. Hoolock (*Hylobates hoolock* Harlan)
23. Ibex (*Capra ibex* Linnaeus)
24. Kashmir Stag or Hangul (*Cervus elaphus hanglu* Wagner)
25. Langur, Capped (*Presbytis pileatus* Blyth)
26. Langur, Nilgiri (*Presbytis johni* Fischer)
27. Leopard (*Panthera pardus* Linnaeus)
28. Leopard, Clouded (*Neofelis nebulosa* Griffith)
29. Leopard, Snow (*Panthera uncia* Schreber)
30. Lion, Indian (*Panthera leo persica* Meyer)
31. Lynx (*Felis lynx* Linnaeus)
32. Macaque, Liontailed (*Macaca silenus* Linnaeus)
33. Markhor (*Capra falconeri* Wagner)
34. Panda, Red or Cat-Bear (*Ailurus fulgens* F. Cuvier)
35. Rhinoceros. The Great Indian Onehorned (*Rhinoceros unicornis* Linnaeus)
36. Tahr, Nilgiri (*Hermitragus hylocrius* Ogilby)
37. Tiger (*Panthera tigris* Linnaeus)
38. Wolf (*Canis lupus* Linnaeus)

¹ 1970. Report of the Expert Committee of the Indian Board for Wildlife—Wildlife Conservation in India : Appendix F. pp 123-124. *Cheeta* (*Acinonyx jubatus* Schreber) not included, being extinct in India.

APPENDIX 44. 1—Concl'd.

BIRDS

39. Bustard, Great Indian (*Choriotis nigriceps* Vigors)
40. Courser, Jerdon's (*Cursorius bitorquatus* Blyth)
41. Crane, Siberian or Great White (*Grus leucogeranus* Pallas)
42. Duck, Pinkheaded (*Rhodonessa caryophyllacea* Latham)
43. Duck, Whitewinged Wood (*Cairina scutulata* S. Müller)
44. Florican, Bengal (*Eupodotis bengalensis bengalensis* Gmelin).
45. Hornbill, Indian Pied (*Anthracoceros Malabaricus* Gmelin)
46. Pheasant, Cheer (*Catreus wallichii* Hardwicke)
47. Pheasant, Monal (*Lophophorus impeianus* Latham)
48. Pheasant, Peacock (*Polypectron bicalcaratum bakeri* Lowe)
49. Quail, Mountain (*Ophrysia superciliosa* Gray)
50. Tragopan, Blyth's (*Tragopan blythii blythii* Jerdon)
51. Tragopan, Satyr or Crimson Horned Pheasant (*Tragopan satyra* Linnaeus)
52. Tragopan, Western or Western Horned Pheasant (*Tragopan melanocephalus* Gray)

REPTILES

53. Estuarine crocodile (*Crocodilus porosus* Schneider)
54. Gharial (*Gavialis gangeticus* Gray)

APPENDIX 44.2

(Paragraph 44.6.6)

Extracts from the Resolutions of the XV Meeting of the Tourist Development Council

RESOLUTION NO. 13 PROPER MANAGEMENT OF NATIONAL PARKS AND WILDLIFE SANCTUARIES

- RECOGNISING . . . that India has a vast potential for wildlife tourism, noting with concern the tremendous pressures to which this rich heritage is subjected to, and
- REALISING . . . that this heritage has a secure future only in National Parks/Wildlife Sanctuaries,
- WELCOMING . . . the enactment by Parliament recently of the wildlife (Protection) Act and the taking up of Project Tiger aimed at saving this beautiful animal from extinction,
- RESOLVED . . . that immediate steps be taken by the State Governments to evolve comprehensive plans for conservation and management of this resource keeping in view the following :
- (a) setting up of special wings within the Forest Departments of State Governments to administer wild life areas;
 - (b) preparation of detailed master plans for selected National Parks and Wildlife Sanctuaries incorporating measures to ensure proper protection from poaching, grazing by cattle, illicit exploitation of forest produce and other unnecessary human interference leading to ecological imbalances and also envisaging a special research cell for proper understanding of wildlife, their diseases and habitat requirements.
 - (c) setting up of an agency by the respective State Governments to implement such master plans within a specified period;
 - (d) the effect of large-scale denudation of forest wealth as a result of major irrigation and hydel projects, establishment of industrial plants, mining, quarrying, etc.
- RESOLVED FURTHER. that (i) the Indian Board for Wildlife may examine the question of translocation of wildlife species like lion, wild buffalo, etc. to other ecologically suitable areas in the country. (ii) advantage be taken of the expertise available with international agencies like the World Wildlife Fund, the IUCN etc. for effective wildlife conservation and management in the country.

APPENDIX 44.2—*Concl'd.*

RESOLUTION NO. 14

TRAINING OF PERSONNEL.

ORGANISATION OF WILDLIFE TOURISM IN THE STATE

UNIFORM ENTRANCE AND PHOTOGRAPHY FEE IN GAME SANCTUARIES.

APPRECIATING .

- . the diversity of India's wildlife resource, noting its potential for tourism on its own as well as in combination with our cultural and historical assets,

RESOLVED .

- . that active steps be taken by the central and State Governments to develop wildlife tourism in selected national parks and wildlife sanctuaries incorporating the following :

- (a) augmentation of existing accommodation, transport and other facilities, provision of trained staff to operate reservation, reception, catering, communication and wildlife viewing facilities and entrust their management to a tourism corporation or exempt these operations from limitations of Government procedures to ensure effective functioning;
- (b) introduction of uniform entrance and photography fees;
- (c) setting up of safari parks, marine, mountain and desert national parks and promotion of special interest tours like bird watching, botanising, sports fishing, trekking and mountain climbing;
- (d) organising wildlife viewing and other special interest tours in cooperation with wildlife outfitters, travel agents and tour operators;
- (e) production of publicity material like wildlife films, picture postcards, maps, brochures, etc. and screening of wildlife and culture films in National Parks/Wildlife Sanctuaries and setting up of wildlife libraries for visitors.

FOREST PROTECTION AND LAW

1 INTRODUCTION

45.1.1 Forest protection has been defined¹ as the activities designed towards the prevention and control of damage to forests, by man, animals, fire, insects, diseases or other injurious and destructive agencies. The primary forest protection problems are in respect of forest grazing, fire, theft and encroachments. Forest grazing is a major issue by itself. It has both the negative element as a cause of forest destruction and the positive one as a tool for rural development. As such, we have dealt with forest grazing in Chapter 42 on Production and Social Forestry. We are aware that protection of forests from insects, pests and pathogens would be a major concern, while implementing programmes of production and social forestry. The current situation and desirable control measures have been discussed in that chapter and the urgent research needs in this respect in Chapter 46 on Forest Planning, Research and Education. Theft and encroachments are human factors, and cannot be tackled by legislation alone. It requires a deeper look into the malaise. The rights and concessions in the forests are to some degree responsible for the destruction of forests, and suitable measures — legislative or otherwise — need to be taken to solve the problem.

45.1.2 Considering the importance of forests, forest reservations started a little more than hundred years back to hold the forest frontiers somewhere. Forest Acts for the purpose were formulated and revised from time to time. The compulsions of the time and state responsibilities continue to create new situations, requiring a new approach to forest legislation. The lack of uniformity in the approach to matters like the control over sandalwood or rosewood has been felt by different States. The inadequacy of punitive measures in some of the state forest Acts has also been noted. There is a view that forest law should be remoulded to become a positive tool for development. We have, therefore, considered forest law in some detail in this chapter.

¹ 1960. Indian Forest and Forest Products Terminology, Part I, Forests — Indian Forest Records (New Series), Silviculture, Vol. X, No. 6 Delhi, Manager of Publications, Government of India.

2 FOREST FIRE

45.2.1 Regulated or controlled fire is a very useful and legitimate tool in forestry practices for the accomplishment of specific purposes. For instance, natural regeneration of teak (*Tectona grandis* Linn.f.), *sal* (*Shorea robusta* Gaertn.f.) and *deodar* (*Cedrus deodara* (D.Don) G.Don f. in more moist regions of their habitat is intimately associated with the role of controlled fires, which, by keeping down the evergreen trees, shrubs and weeds, reducing the depth of leaf litter and exposing the mineral soil, create requisite seed bed conditions for the germination and establishment of seedlings of the desired species. The technique of *rab* regeneration of teak on well burnt patches in the southern States is based on the use of controlled fire in increasing replaceable calcium, potassium etc. in the forest soil and in reducing soil acidity. Deliberate and controlled burning is a regular feature in the *chir* (*Pinus roxburghii* Sargent) pine forests to prevent occurrence of more destructive accidental or malicious fires in the hot weather. In Uttar Pradesh, 'deep winter' control burning of plantations over 5 years old, including plantations of eucalypts, has been used with conspicuous success.

45.2.2 When we refer to protection from fire, we mean the unregulated forest fires, one of the most potent sources of damage to the forests. The injuries caused by forest fires occur to (a) standing crop, (b) soil, (c) productive capacity of the forest, (d) protective value of the forest, (e) wildlife, and (f) recreational and scenic values. It is important to ascertain and maintain an authentic record, as far as possible, of the causes of forest fires, with a view to planning fire prevention measures, and for the elimination of each source of fire. Such authentic statistics are not yet being maintained.

Types and Causes

45.2.3 A uniform classification of forest fires by types and causes should be evolved and adopted by all the States. With the setting up of an adequate organisation at the Centre and the States for collection and compilation of forest statistics, it would be relatively easy to classify and report forest fires. Three types of forest fires are prevalent: (a) ground fires, (b) surface fires and (c) crown fires. Ground fires occur in the humus and peaty layers beneath the litter of undecomposed portion of forest floor with intense heat but practically no flame. Such fires are relatively rare, and have been recorded occasionally at high level Himalayan fir and spruce forests. Surface fires, occurring on or near the ground in the litter, ground cover, brushwood and reproduction, are the most common type in all fire-prone forests

of the country. Crown fires, occurring in the crowns of trees, consuming foliage and usually killing the trees, are met frequently in low level coniferous forests in the Siwaliks and the Himalayas.

45.2.4 Regarding the causes of forest fires, there are three main classes: (a) natural, (b) unintentional/accidental due to man and (c) deliberate/intentional/incendiary due to man. Natural fires occur mostly due to lighting and sometimes due to rolling stones and rubbing of dry bamboos with each other. Unintentional or accidental fires occur in a forest due to careless throwing of match-sticks and burning ends of cigarettes and *bidis*, carrying of naked fire by people passing through forests, spread of fire from labour camps and recreation or picnic sites. Sometimes the villagers on the outskirts of the forests, particularly in the submontane belt, set fire to the brushwood and other miscellaneous growth on their fields just before the pre-monsoon shower in order to enrich their fields with the resultant ash. Quite often this fire spreads to the adjoining forests. The Forest Departments carry out annual burning of fire lines in the forests, and sometimes accidental fire damage originates from this source. Most of the forest fires can, however, be traced to deliberate actions of man. Forests are set fire to for inducing luscious growth of grass for better grazing by the village cattle. Villagers sometimes set fire to a forest from one end and spread nets on the other side to catch the wild animals running away. The enmity with forest staff is also responsible for incendiary activities in the forest areas by the neighbouring rural population. Incendiary fire due to sheer malice is not unknown. Fires are caused by the villagers for collecting minor forest produce, like honey, *mahua* (*Madhuca longifolia* (Keoning) MacBride) flowers, etc.

45.2.5 No doubt, adequate and effective fire control measures would have to take note of the various factors influencing the frequency, spread and severity of fires, such as the nature of forest formation (from the point of view of fuel type present), climate, topography, etc. As we have pointed out above most of the forest fires are started by man and in most cases deliberately. Routine methods of fire protection are at best a poor remedy against wilful burning and forest fires are consequently a serious and difficult problem. An exhaustive record of forest fires by types and classes should be maintained, in order that these could be analysed and effective steps taken in fire protection. In Appendix 45.1, we have suggested an illustrative proforma for maintenance and report of fire damages. In Chapter 46 on Forest Planning, Research and Education, we have recommended setting up of an adequate organisation for collection of forest statistics, and we are of the view that there would then be no difficulty in keeping an authentic record of forest fires in the years to come.

45.2.6 We have tried to analyse the available statistics to find out the fire-susceptible areas in India. We have calculated the average of the number of fires reported, area burnt and damages in value terms for two periods of 5 years such, from 1960-61 to 1964-65 and 1968-69 to 1972-73. The figures are reproduced in Appendix 45.2. Though no pattern emerges and the appendix speaks of dearth in collecting and collating data, the damage due to fire is quite substantial. Even in Assam, which is in a wet zone, the annual damage is quite significant. The coniferous forests in Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh are in general quite vulnerable to forest fires. We have recommended later prevention and presuppression measures, which if properly carried out, would reduce the fire hazards substantially. In India, there is a definite dry hot season before the monsoon, during which period most of the forest fires occur. Even in wet areas in the foothills of the Himalayas, the *sal* forests are quite prone to fire damages during this period. The other vulnerable areas are the deciduous forests in the heartland of India in Bihar, Orissa, Madhya Pradesh, Andhra Pradesh and Maharashtra, and forests in Haryana and Punjab, the latter probably due to these forests being mostly roadside and canal-side plantations. While our observations regarding control of fires would be generally applicable to all areas the organisational set up suggested would be particularly applicable to the fire-prone areas indicated above. The man-made forests of fast-growing species would also be vulnerable to fire. In our Interim Report on Production Forestry — Man-made Forests, we have recommended commercial approach to production forestry. Forest corporations have already been set up in a number of States to take up this work. Due to the fact that production forestry will be commercially oriented, it will be necessary to compute the damages due to fire quite accurately. Not only the damage to the existing crop, but also the cost of rehabilitating the area including cost of replanting and subsequent maintenance, should be computed. The information would be utilised by the corporations for setting apart annually a certain specified sum in their profit and loss accounts to create a reserve or sinking fund.

Preventive and Control Measures

45.2.7 Control measures may be sub-divided into three distinct phases, viz. prevention, presuppression and suppression. Prevention comprises fire control activities pertaining to reduction of the number of fires through public education, legislative measures and reduction of fire hazard. Presuppression concerns the organisation, training and management of fire control activities to ensure effective fire suppression. Suppression covers all activities concerning the extinguishing of a

fire after its detection. Reduction of fire hazard may also be considered a presuppression activity.

45.2.8 Man-caused fires can be prevented in any region only to the extent that the local population realise the direct and indirect benefits of the forests and the resultant losses accruing to them from fires. The traditional steps are public education through press and radio, books, posters and signs, films and lectures. In Gujarat, cooperative groups called *van-rakshak dals* have been formed. In a number of States, for instance Uttar Pradesh, Himachal Pradesh, Haryana, Punjab and Gujarat, there are publicity and extension divisions, with vehicles equipped with generators, motion picture projectors, etc. for organising lectures, exhibits, documentary films, etc. There is much more to be done in this regard. We have recommended in our Interim Reports on Social Forestry and Forest Research and Education that the subject of forestry should be taught in some form or the other in the agricultural and other universities. The Central Board of Forestry has long been advocating the introduction of elementary forest education in schools and colleges. With the knowledge of forestry spreading at popular levels where there is more intimate contact with the rural population, it is hoped that an enlightened public consciousness would be created and it would be possible to organise voluntary associations with local leadership to support administrative measures for protection from fire. Grant of letters of appreciation and cash rewards to local *Panchayats* and *van-rakshak dals* in fire-prone areas for their fruitful cooperation and assistance should be arranged. Publicity should be ensured both among urban and rural groups of population. The audio-visual medium should be used imaginatively for this purpose.

45.2.9 Regarding legislation, we have dealt with the amendment of forest law in general in Sections 4 and 5. Here we refer only to specific provisions that have to be made for fire control. There should be a provision for the award of enhanced punishment to those who may cause damage to a forest by wilfully setting fire to it. The following measures need also to be specifically included in the amended forest law:

- (i) investing gazetted forest officers with magisterial powers, or appointment of special magistrates, for summary trial in cases of offences relating to forest fires; and
- (ii) in case of repeated man-caused fires in any locality, closing the forests for such time as the Government thinks fit and suspending all rights of grazing and abrogation of other concessions, rights and privileges of the community in the locality.

45.2.10 The working plans and project plans should specify operations necessary to reduce fire hazard. Disposal of slash, felling

debris and conversion waste and controlled burning should be provided for in the working plans, in addition to other silvicultural prescriptions for fire protection in coniferous and hardwood forests and plantations of fire-tender or fire-susceptible species, and presuppression operation.

45.2.11 For detection of forest fires, most of the States engage local fire watchers during the fire season for ground patrolling, and employ them on other forest operations during the rest of the period. In view of the abundance of unemployed and underemployed labour in most parts of the country, this practice should be widely adopted, with only one reservation. i.e. continuance of the job must be related to performance. A network of lookout stations should be built. Experience elsewhere indicates that in most parts an area within 10-16 km radius of the primary (manned continuously during fire season) lookout stations can be covered for fire detection. Lookout stations, when located at accessible points, can also assist in an education campaign for fire prevention.

45.2.12 A reliable communication and transport system is essential in all branches of fire control. It is not necessary to adopt the highly costly radio telephone system everywhere. A private forestry circuit for telephones in forest areas, which would be relatively simpler and cheaper, should serve the purpose in most places. Uttar Pradesh and Gujarat have forest telephones and the system is being extended to the extent funds permit. As and when forests start being intensively managed, a forest road system would be built in all the areas. Roads and paths serve as useful fire-breaks. Hence the main roads, subsidiary roads, inspection paths, etc. should be so planned that they become part of a well-planned system of fire-breaks/fire lines. The benefit accruing due to fire protection should be included for determining the cost-benefit ratio of road projects.

45.2.13 It may be mentioned that in the Dangs Forest Division in Gujarat, a system of wireless transmission sets is in operation for the quick transmission of fire occurrence reports. The system consists of one wireless control station at Ahwa, Divisional headquarters, and of fire sub-stations at Forest Range headquarters. A jeep fitted with a wireless set is also maintained at the control station to rush fire-fighting crew to the spot and also to mobilise local manpower and organise fire-fighting. Twenty-three fire stations manned by fire watchers are situated on the tops of high hills, commanding a considerable view of the forest area around, and are maintained in the fire season. There is also a practice of giving rewards to the village *Patils* and *Karbharies* and other villagers who render outstanding help in fire protection.

45.2.14 Fuel (i.e. presence of logging slash, dry standing trees, brushwood, etc.) reduction and fuel mapping is a pre-requisite of pre-suppression activities. The fuel reduction can be brought about by controlled burning, early burning or light burning. Regarding fuel mapping, fuel condition for a particular forest area should be shown in the form of maps, to be prepared for all fire-prone areas previously identified. The maps should show the probable rate of spread of fire and resistance to control. The concept of "fuel-types" in India, which would guide the mapping, should be developed by the Forest Research Institute (FRI), Dehra Dun and the personnel to be engaged in the States for forest fire control should get adequate training in this regard at the FRI.

45.2.15 There are no well planned fire protection organisations in the States at present, except for the limited organisations in some of the States referred to earlier. The Uttar Pradesh Forest Department has proposed to organise fire protection measures during the Fifth Plan, and we are of the view that with suitable modifications the pattern of organisation could be adopted in other States, having fire-prone forest areas. The outlines are that for quick fire detection and relaying of information, there should be watch towers, from where information could be transmitted to the controlling station. One or more fire-fighting units would be maintained at the controlling station during the fire season. Each unit would consist of 25 men under the charge of a Deputy Ranger and one truck for their quick transport, equipped with VHF wireless sets and fire-fighting equipment. Each unit would be able to operate in an area commanded by 4-5 watch towers. The controlling centre would be at the forest range headquarters.

45.2.16 Training programmes in fire detection, prevention and suppression should be arranged for all levels of field officers. There should also be group discussions with the subordinate staff organised by the forest officers. This will provide an efficient force and keep all concerned alive to the urgency of protecting the forests from fire.

45.2.17 There is hardly any research on fire protection (detection, pre-suppression and suppression operations) in India. It is not necessary to launch an ambitious and sophisticated research scheme straight-away. But we are of the view that, to start with, the FRI could give a lead in research on various topics concerning forest fires, such as effects of fires (beneficial and injurious) and their quantitative measurement, fuel hazard reduction, fire detection, economical designs of fire watch towers, fire behaviour, fire hazard forecasts, economics of fire protection operations, etc. A research project involving the States having fire-prone areas should be evolved and centrally coordinated by the FRI.

45.2.18 Protection of forests from fire will assume great significance with the emphasis that we have placed on the establishment of large scale man-made forests in our Interim Report on Production Forestry — Man-made Forests. We have indicated in paragraph 41.3.3 in Chapter 41 on Forest Policy that there are over 2 million ha of man-made forests created upto 1972. The tempo of man-made forestry activity is expected to rise much faster. Most of the plantations of fast-growing and other species of industrial importance are exposed to serious hazards of fire. Occurrence of fire damage has been noticed in several plantation areas. It would be necessary to develop an adequate system of fire protection to safeguard the investment made in plantation forestry. At the present time forest fire protection is rudimentary when compared with the systems which have been developed in countries like Australia, New Zealand, Canada or USA. The lack of necessary facilities for fire prevention has been felt, particularly in man-made forests, which are the areas of high fire risk. The danger of severe fire damage will become more acute as the area under man-made forests increases. Hence, all the steps of fire protection that we have outlined in this section should be immediately introduced.

3 PROTECTION FROM DESTRUCTION AND ENCROACHMENT

45.3.1 We have earlier pointed out that the real hurdles in the development of forest wealth are the unauthorised removal of forest produce and encroachment on forest lands, and consequent destruction of good productive forests. The rights of collection and use of timber, fuel and minor forest produce, free or at concessional rates, by the villagers have often degenerated to sheer exploitation of forests without any thought to the productive capacity of the forests or to the need for investment in forestry for production of forest materials at an economic rate. The rights and concessions have also been convenient tools for entering the forests for carrying out clandestine removal of forest produce. In this connection we quote from paragraph 7.3 of our Interim Report on Production Forestry — Man-made Forests to indicate our general approach :

“It is not only a social conscience which should make the foresters try and meet the reasonable demands for firewood at reasonable prices, but the need to protect their valuable forests from poaching and pilferage which causes tremendous loss in ultimate forest wealth should also make them conscious of the need for meeting fuelwood demand in the country. In conservation forestry, where

investments are low, the forester may not have noticed the pilferage with much alarm but a programme of commercial forestry should make him think whether he can afford to look upon pilferage with the same blind eye."

Rights and privileges and the unauthorised removal of forest produce and encroachment on forest lands are the two facets of the same disease; hence we are discussing them together in this section.

Rights and Concessions

45.3.2 A specified class of people are allowed to collect some forest produce for bonafide domestic and agricultural purposes, either free or at concessional rates, but not for sale, barter, gift, export or wasteful use. The most widespread and common terminology for this system is 'forest *nistar*'. Thus forest *nistar* generally includes timber of some specified species for agricultural implements, houses and cattle sheds, fuelwood, bamboos, thatching and fodder grass, fencing material, bark, fibre, minor minerals, edible fruits, flowers, roots, naturally exuded gum, honey, wax, etc. *Nistar* extended to village artisans and craftsmen for carrying on their occupation is termed 'occupational *nistar*'.

45.3.3 In this country, scientific forestry commenced in the early sixties of the last century, when Forest Departments were created in the various British provinces. The first task that devolved on forest officers was to inspect treeclad lands and all hilly regions, and then to demarcate, survey and map-suitable areas for settlement as 'reserved' or 'protected' forests under the newly enacted Indian Forest Act, 1865. After this, general principles were laid down in the national forest policy of 1894, on which they were to be managed. The sole object with which State forests were to be administered was public benefit. In general, the constitution and preservation of a forest involved the regulation of the rights and the restriction of the privileges of the user in the forest by the neighbouring population. Forests yielding inferior timber, fuelwood or fodder or used for grazing were to be managed in the interest of the local population, care being taken to see that the rights of user was so regulated that the forests were not destroyed and the people were protected against their own improvidence. The existing rights in the commercial and the protection forests declared as 'reserved' were to be settled, transferred or commuted, but the rights over the 'protected' forests, which were extensive, were to be merely recorded and regulated.

45.3.4 At that time forests were extensive and the pressure of population on them was not very great. Therefore, the neighbouring population was allowed to obtain its requirements of forest products for

bonafide domestic use from the most convenient areas either free or on nominal payment. Indeed, wasteful removal was not objected to.

45.3.5 Later on, elaborate procedure was prescribed under the Indian Forest Act, 1927 "to enquire into and determine the existence, nature and extent of any rights alleged to exist in favour of any person in or over any land comprised within" the proposed 'reserved' forests, "or in or over any forest produce, and to deal with the same as provided....." The salient features of the law were :

- (i) after a notification is issued declaring that it has been decided to constitute any land a reserved forest, no right shall be acquired in or over the land comprised in such notification, except by succession or under a grant of contract in writing made or entered into by some person in whom such right was vested when the notification was issued;
- (ii) rights in respect of which no claim has been preferred within a stipulated time, and of the existence of which no knowledge has been acquired by enquiry by the 'Forest Settlement Officer', shall be extinguished;
- (iii) when right to shifting cultivation was admitted wholly or in part, its exercise might be arranged by excluding land for the purposes of the claimants or by causing certain portions of the land under settlement to be separately demarcated for the practice of shifting cultivation, subject in all cases to control, restriction and abolition by the State Governments;
- (iv) in the case of a claim to a right in or over any land, other than a right-of-way or right of pasture, or a right to forest produce or a water course, the same could be admitted in whole or in part and for the purpose such land could be excluded from the proposed forest or acquired under the Land Acquisition Act, 1894, or an understanding reached with the owner for the surrender of his right;
- (v) in the case of a claim to rights of pasture or to forest produce, the record when the claim is admitted in whole or in part would specify the number and description of the cattle which the claimant was from time to time allowed to graze, the season during which such pasture was permitted, the quantity of timber and other forest produce which he was from time to time authorised to take or receive and whether the timber etc. so obtained could be sold or bartered; and
- (vi) the Forest Settlement Officer was to record all rights admitted by him, whether in the proposed forest or by setting out some

other forest tract; he could also alter the limits of the proposed forest as to exclude forest land of sufficient extent, and in a locality reasonably convenient, for the purposes of the claimants.

45.3.6 In case a Government forest was declared a 'protected' forest, the nature and extent of the rights of private person in or over the forest land or waste land comprised therein would have to be enquired into and the recorded at a survey or settlement. It was the State Governments' prerogative to suspend the rights over any portion of such forest, provided the remainder of such forest be sufficient, and in a locality reasonably convenient, for the due exercise of the rights suspended in the portion so closed. Any trees or class of trees could be declared 'reserved', and some specified acts prohibited in such forest. However, by and large, the protected forests came to be burdened with considerable rights.

45.3.7 As the population of men and livestock increased, more and more of forest land was excised and brought under the plough. The requirements of forest products also increased and the production progressively diminished due to over-exploitation and uncontrolled grazing. Some changes were brought about in the procedure governing *nistar*. In some cases removals were permitted only on payment (still nominal) from specified forest, in particular seasons and to a fixed extent. Where the produce available was in limited quantities agriculturists were given preference. The system of commutation, whereby individuals or families were allowed to remove specified quantities once a year, was introduced in certain forests. But it was not yet considered necessary to legislate in the matter.

45.3.8 Such was the state of affairs in the British provinces. In the princely states and in forests owned by *zamindars*, *malguzars* or *taluqdars*, *nistar* to the *ryots* was regulated according to the wishes of the proprietors.

45.3.9 After Independence, the State Governments gradually did away with the private ownership of forests. While legislation was on the anvil, the proprietors started cashing the forest growth as fast as they could. The people in their turn started ruthlessly plundering the forest growth, before an administrative set-up to protect the vested forests could be properly organised. The ownership of these forests vested with the Government with all the associated rights and privileges, but the forests were largely in a depleted state and almost barren. These vested forests were generally classified as 'unclassed' forests. Subsequently some of these unclassified forests were declared as 'protected' forests under the forest law of the State. In some States like Maharashtra and Madhya Pradesh, the privileges and concessions granted by the ex-proprietors were recorded, generally in the form of

nistar patraks after consulting the old village records and enquiries conducted by a responsible Revenue Officer called the Nistar Officer. Thus, after documentation of the privileges and concessions, the Government undertook to meet them over a long period from the ex-proprietary forest areas.

45.3.10 An attempt was made by the State of Madhya Pradesh in 1956 to satisfactorily solve the vexatious problem of meeting the *nistar* demand, and at the same time to prevent further deterioration of the already depleted forests. The State appointed a Nistar Policy Committee with some Ministers, Members of the State Legislature and the Chief Conservator of Forests to go into this question. The Committee made comprehensive recommendations. It was decided to prepare working schemes for management of all the ex-proprietary forests transferred to the Forest Department so as to maintain the productive capacity in perpetuity. Most of the working schemes set apart forest areas for *nistar* by constituting 'minor forest working circle'. The general objects of management were : (a) to restrict felling of trees for *nistar* to areas under the working circle, (b) to minimise the damage to these forests by preparing simple felling rules for removal of small timber and fuel for *nistar*, and (c) to prevent indiscriminate grazing over the area. It was particularly intended to close the areas under working schemes to grazing, in the interest of regeneration and recouplement. Felling rules were prescribed to protect all young regeneration below 9 cm breast height girth (bhg) and edible fruit bearing trees. Species like teak, *bija sal* (*Pterocarpus marsupium* Roxb.), rose-wood (*Dalbergia latifolia* Roxb.), *haldū* (*Adina cordifolia* Benth. HK.f.ex Brandis) and *shiwan* or *gambhar* (*Gmelina arborea* Roxb.) were reserved against felling. However, the recommendations of the Nistar Policy Committee were not fully implemented.

45.3.11 In Eastern Maharashtra, where the forests were transferred from Madhya Pradesh after the States' reorganisation, the Government has prescribed that 30.75 ha of forest area for 100 cattle are to be set aside for grazing. From the same area small timber for bona-fide use is permitted by felling trees upto 60 cm bhg except those listed above. Bigger trees are to be felled only when dead and dry.

45.3.12 Another State where the problem of rights and concessions is acute is Orissa. It is due to the special circumstances in the State, where a large part of the present day Government forests came under its control after the merger of the ex-princely states and the vesting of ex-zamindari forests. The total forest area under the Government before the merger of the ex-princely states with Orissa on January 1, 1948 was about 6,185 sq km. Immediately after the merger the area went up to about 25,420 sq km. Some more forest area of the ex-princely states were added in later years. Substantial forest area was

added on vesting of *ex-zamindari* forests, and the total forest area as on April 1, 1971 stood at 67,460 sq km. A brief account of the rights and concessions in the forests of Orissa is given in Appendix 45.3, a perusal of which will show the complexity of the problem and the damage that is being caused to the forests.

45.3.13 *Nistar* demand on forests set apart for the purpose has continued to increase. But the supplies are rapidly dwindling, partly because of clandestine removal from forests, partly due to disforestation, and partly due to the fact that not much systematic effort has been made to create large scale fuel plantations. Government is now finding it increasingly difficult to meet even the minimum indispensable requirement of the people. In some parts of the country, e.g. Bastar in Madhya Pradesh, it is laid down that where forests set apart for the exercise of concessions (*nistari* forest) are not adequate to meet the entire demand of the villagers, they are allowed to collect material from the nearest reserved forest on payment of a nominal commutation fee. This arrangement imposes more strain on the productive uses of forests.

45.3.14 The Prevalent practices, customs, concessions and privileges differ widely from State to State. It would be observed that the *nistar* problems are more acute in States like Madhya Pradesh, Maharashtra, Bihar, Orissa, Rajasthan and Andhra Pradesh. An attempt was made to impute a market value to the forest products removed free or at concessional rates, and for a few States the position was found to be as given in Table 45.1.

TABLE 45.1

Estimated Value of the Forest Products Consumed by Free Grantees and Right-holders¹

(Rs. in lakhs)

State	Reference year	Total estimated value	Total revenue realised	Percentage of col. 3 to col. 4
Gujarat	1972-73	17.10	497.80	3.4
Karnataka	1972-73	14.62	2,084.82	0.7
Rajasthan	1971-72	34.54	128.70	26.8
Uttar Pradesh	1970-71	115.50	2,147.86	5.4

A common feature of free availability of various MFP, like wild edible fruits, flowers, roots, bark, fibre, thatching and fencing material, minor minerals like surface boulders, murrum and earth, honey, wax, etc. exists almost in all the States. For instance even though West

¹ Chief Conservators of Forests.

Bengal does not have *nistar* as such, free collection and use of *mahua* fruits and flowers and *sal* leaves are allowed in the forests in the south western part of the State.

45.3.15 It is desirable that *nistar* should be regularised in such a manner that on the one hand the deserving people get their essential requirement conveniently and at reasonable rates, and on the other the productivity of the forests is maintained. A rational approach to *nistar* is now necessary, particularly in the context of our recommendations for production and social forestry. An example of how project planning for production forestry gets affected by *nistar* is given in the report for an intensive forestry project in Eastern Maharashtra¹. A potential plantable area of about 7,390 sq km was identified, after excluding developed areas and making allowances for environmental reserves and submergence. But it was found that at least 1,020 sq km would have to be kept apart for the satisfaction of *nistar* rights of the villagers. Almost double the areas—2,250 sq km to be precise—was excluded to find the net plantable area available for the project, which now is to cover 5,140 sq km. This shows that about 30 per cent of the total forest area was set apart for *nistar*.

45.3.16 There can be no single approach to the solution to the problem of *nistar*. So far as the legal side is concerned, we have already indicated how the record of rights is made, after extinction of such rights in whole or in part, in a reserved forest. We suggest that all unclassified and protected forests should be constituted into reserved forests at the earliest possible, in order that *nistar* rights could be extinguished as far as possible in the manner provided in the forest law. Apart from the legal position, steps would have to be taken for meeting the essential requirement of forest produce of the rural people at reasonable prices. In Chapter 41 on Forest Policy, we have said that free supply of forest produce to the rural population and their rights and privileges have brought destruction to the forests and so it is necessary to reverse the process. We have discussed in Chapter 42 on Production and Social Forestry how production forestry should be organised to confer the maximum benefit from employment to the vulnerable section, who would then be in a position to pay a reasonable price for forest products.

45.3.17 In our Interim Report on Social Forestry, we have indicated that large scale adoption of programmes for social forestry should be taken up in such a way as to make it possible to meet the needs of the rural people of forest produce from readily accessible areas. This step would decrease the burden on production forests.

¹ 1973 (September). Formulation and Economic Assessment of an Intensive Forestry Project in Eastern Maharashtra, p. 36. New Delhi, Planning Commission — Maharashtra Forest Department — Ford Foundation.

Nistar demands are to be met through such programmes. We are of the view that the procedure allowing *nistar* to be collected from forests has caused irreparable damage to them, not because the bonafide requirement of the rural people could not be met, but because pilferages for trade and sale take place in the guise of *nistar*.

45.3.18 The bonafide requirements of the villagers should be linked up with production and social forestry. More and more of fuel-wood and small timber would be available for local distribution when production forestry programme is taken up. The villagers' requirements would also be met from social forests, wherever created, and by this means it would be possible to exclude increasing number of people from considerations of *nistar*. We are of the view that in any case the villagers should not be allowed to collect *nistar* themselves from the forests. Instead, *nistar bhandars* (depots) may be established at convenient places by the Forest Departments for meeting the bonafide requirements of the people. For supply from *nistar bhandars*, a charge should be made, which should include the cost of production, transport, depot charges as also a nominal profit. Ultimately *nistar* should be abolished. Similarly, the system of commutation (also known as *nistar* cess in Orissa), whereunder on payment of a stipulated nominal fee once a year the payee is entitled to remove the specified forest produce, should be abolished. So far as rights for grazing are considered, we have indicated the approach in Chapter 42 on Production and Social Forestry.

45.3.19 We are aware that it will take some time before conditions can be created for abolition of *nistar* rights and cess. As an interim measure, we recommend that as far as possible separate areas of forests should be set aside for meeting the *nistar* demands. Association of *panchayats* for protection of *nistar* forests would be essential. Forests situated near habitation and not considered suitable for meeting the commercial and industrial demand may be set aside for the purpose. The Eastern Maharashtra project referred to in paragraph 45.3.15 has sought to do this by excluding about 30 per cent of the total forest area in the locality. It is found all too often that this step affords only a temporary respite to production forestry, and in a short time, the frontiers of defence get shifted. The Government should create adequate administrative and socio-political climate, so that once *nistar* forests are demarcated, no rights and privileges are allowed in parts reserved for production forestry and for conservation of nature or environment. Subsequently, some of the *nistar* forests may be brought back to the folds of production forestry after ensuring the supply of local requirement through *nistar bhandars*.

45.3.20 Some States, like Orissa, have a large extent of unclassed forests or unreserves or undemarcated protected forests. A large part

of it is being disforested in the new settlement operations. In such cases, *nistar* rights should also be proportionately abolished. In some States, e.g. in Meghalaya, there are large tracts of forests belonging to the autonomous district councils. These can be considered similar to village forests and are at present being managed for the satisfaction of local needs. As recommended in our Interim Report on Social Forestry, *panchayats* should be associated in raising plantations of fuel and fodder species near villages and *nistar* demand met from these areas. The State Governments concerned should take recourse to all steps needed to bring this about. Wherever the *nistar* demand is acute and the available forests are not capable of meeting it without adversely affecting production and there is enough wasteland available nearby, this should be utilised for producing fuel and hay as also other products considered indispensable by the *nistaris*.

45.3.21 The quantum of materials to be given per individual household should be fixed with due regard to the indispensable and essential needs on the one hand and actual availability on the other, preference being given to the agriculturists and village artisans. In the tracts where the concessionists or right-holders are allowed certain fixed quantities of wood or bamboos every year, because these deteriorate during the course of the year, it would be desirable to supply them wood/bamboos after treating them with preservative so that they last for a longer period. Under this arrangement, it should be possible to distribute the available wood/bamboos at longer intervals. There would thus be less *nistar* demand, and consequently less burden on production and social forests.

Clandestine Removal and Encroachment in Forests

45.3.22 In our Interim Report on Social Forestry, we have drawn attention to the gravity of the problem of protection and scientific management of forests in the neighbourhood of centres of consumption. Many States have created mobile squads, special protection forest circles and forest divisions. We have expressed doubt whether such measures alone would help in arresting inroads into the forests. It is argued that the destruction of forests takes place due to unsatisfied demands of fuelwood and small timber of the agriculturists and the rural people. This is partly true, and probably not more than 25 per cent of the damage is due to this factor. To overcome the inherent drawbacks, we have elaborated on the practice of social forestry and made suitable recommendations in this regard.

45.3.23 For the most part, unauthorised removal takes place, because there is unemployment and gross under employment in the rural sector and the only living to be earned is by way of unauthorised

removal of fuelwood and small timber and sale in the nearby semi-urban or rural market places. The system of sale of timber standing in the forests also leaves scope for clandestine removal of trees. Recently, Uttar Pradesh, experienced a local movement in Garhwal and Kumaon hills, which came to be known as "*chipko*" (save the forests)¹. In these hills, only 50 per cent of the forest and wastelands are under the control of the Forest Department. The civil or *panchayat* forests are equal in area to the forests managed by the Department. This leaves scope for venal activities, and it is heartening to note that at least the people in the locality have reacted to malpractices and have desired scientific management of the forests. Correct lessons should be learnt from this movement, and with a little imagination and determination of the administration, it is an easy proposition to utilise this awareness for stopping further destruction of forests.

45.3.24 In Chapter 42 on Production and Social Forestry we have recommended that as far as possible no sale of timber standing in the forests should be made and that no sub-contract should be awarded in departmental logging, which should be done by direct employment of local labour (or their cooperatives) with such reservations as we have indicated therein. We also recommend that for logging, as well as for other forest works, a representative of the village institution (*panchayat*) should be associated when payments to the workers are made.

45.3.25 While the above steps may check damage to forests to a certain extent, the basic cause of destruction of forests would hardly be removed. What is required is the creation of more employment opportunities in forest operations. We have outlined in Chapters 42 and 43 on Production and Social Forestry and Minor Forest Produce the steps that are needed to be taken in this regard. This would require sufficient allocation of funds for forest development and a re-thinking in the order of priorities for financing forest development schemes. Protection of forests would not be possible otherwise. Increase in the number of Forest Guards, setting up of mobile patrol parties or any legislative fiat would not be effective, without a corresponding effort in managing forests for the betterment of income of the total people.

45.3.26 Adequate investment in forest development is needed to protect the forests from unauthorised encroachments, and even to retain essential lands under forestry. That forestry needs also good productive lands has been stressed elsewhere. Lack of adequate investment in forest development has bred a feeling that forests are 'unproductive jungles' and the economy would not be hurt in any way by

¹ Kala, S. C., 1974 (December 4). New Forest Policy in U. P. — First fruit of Chipko. The Times of India, New Delhi.

taking away the marginal lands out of them for farming. A long term view has to be taken and implemented with all the political will that the country can muster.

4 PRESENT STATUS OF FOREST LAWS

45.4.1 Forest legislation dates back to 1865, when the Indian Forest Act was enacted. The Madras Presidency formulated its own Act — Madras Forest Act, 1882. Until a comprehensive Indian Forest Act was formulated in 1927, the following Acts and amendments concerning forest management in British India outside the Madras Presidency were enacted :

- (i) the Indian Forest Act, 1878;
- (ii) the Forest Act, 1890;
- (iii) the Amending Act, 1891;
- (iv) the Indian Forest (Amendment) Act, 1901;
- (v) the Indian Forest (Amendment) Act, 1911;
- (vi) the Repealing and Amending Act, 1914;
- (vii) the Indian Forest Amendment Act, 1918;
- (viii) the Devolution Act, 1920.

Any legislation on forests would naturally have to consider the management of wildlife. We have dealt with wildlife legislation in Chapter 44 on Forest Ecology and Wildlife Management. In the previous two Sections, we have indicated some aspects where the legislation has to be revised.

45.4.2 At the time of formulation of the national forest policy in 1952, forest legislation existed in the Indian Forest Act, 1927 (hereinafter referred to as the Act) and the Madras Forest Act, 1882, so far as the forests under the control of the Central Government and of the then Part A States were concerned. In some of the Part B States, there were forest regulations having the force of law and in some Part C States forest law did not exist at all. In pursuance of the recommendations in the 1952 policy, some of the States enacted their own full scale forest Acts and some extended the provisions of the Indian Forest Act to their territories.

45.4.3 In 1962, the Central Boards of Forestry (CBF) recommended that the suggestions for improvements and changes in the Indian Forest Act in the light of recent developments might be invited from the State Governments, and a proposal for the amendment of the Act in the desired directions should be drawn up. The suggestions of the States/Union Territories were examined by the Standing Committee of the CBF in June, 1963. The Standing Committee set up a Sub-Committee to consider the question of amendment of the Act.

The CBF considered the report of the Sub-Committee in December, 1963 and recommended as follows:

"It was decided that the recommendations of the Sub-Committee as modified by the Ministry of Law and the Ministry of Steel, Mines and Heavy Engineering be forwarded to the State Governments who should initiate action for amending their Forest Acts."

The issue in one aspect of forest management, viz. nationalisation of trade in various minor forest products, came up again for discussion before the CBF in February, 1973. In order that there may be uniformity in respect of this legislation, the CBF recommended revision of the Act.

45.4.4 The Sub-Committee laid more stress on the proper preservation of the forests, and their recommendations were made after considering the provisions of law under three broad aspects, namely (a) remedial, (b) preventive and (c) punitive. The following are among the more important recommendations of the Sub-Committee :

- (i) "gum", "wild animals and skins, tusks and horns" should be classed as 'forest produce', whether found in, or brought from, a forest or not;
- (ii) setting fire to any forest land in respect of which a notification declaring the decision of the State Government, to constitute it as a reserved forest has been issued should be considered as a prohibited act.
- (iii) cultivation or attempts at cultivation in any manner any land contained within a reserved or protected forest should be a prohibited act;
- (iv) additional powers should be delegated to forest officers and police officers to evict a person from the forest land in relation to which he has committed a few specific offences, like breaking up of land for cultivation, etc.;
- (v) the provisions to constitute village forests out of reserved forests should be deleted;
- (vi) special enactment for control over forests and lands not being the property of Government, i.e. private forests, should be made;
- (vii) maximum punishment for forest offences should be increased to an imprisonment for a term which may extend to one year (in place of six months), or with fine which may extend to one thousand rupees (in place of five hundred rupees), or with both;
- (viii) stricter provisions should be made in the Act in order to ensure avoidance of damage to, and destruction of, any forest produce; and

- (ix) with regard to release of forest land for extracting major and minor minerals — (a) in the case of major minerals such as coal and iron mined by open cast method, adequate compensation is to be paid by the licensee to the Forest Departments for compensatory plantations, (b) in the case of deep minings, market value of the trees felled on the mining faces and pitheads should be paid by the licensee to the Forest Departments, (c) licensing authority for minor minerals should be the forest officers so far as forest areas are concerned, and (d) Forest Departments should be competent to frame rules to regulate the felling of trees on the mining faces, pitheads or quarries.

45.4.5 The Ministry of Law in its comments on the proposed amendments pointed out that the Indian Forest Act, 1927 cannot be amended by Parliamentary legislation. The suggested amendment by the Sub-Committee were, however, found to be generally in order, so far as the legal aspects were concerned. Apparently, the Ministry of Law did not examine the issue in the light of Article 252(1) of the Constitution.

45.4.6 Regarding quarrying and mining, the Ministry of Steel, Mines and Heavy Engineering pointed out that quarry leases and licences for minor minerals are granted by the State Governments in accordance with the provisions of the Minor Mineral Concession Rules framed by the respective State Governments. The Ministry also stated that as the State Governments could hope to obtain revenue either from its forest wealth or from its mineral wealth, but not from both at a time, it would not be in order for the State Governments to insist that the lessee should pay to the Forest Departments adequate compensation for compensatory forest plantations, in case open cast mining is done. In areas of high value forest growth, the State Governments can incorporate a special condition in the mining lease for payment of compensation in accordance with the provisions of the Mineral Concession Rules, 1960. The Ministry did not favour inclusion of a general rule.

45.4.7 A comparative study of the Indian Forest Act and the various State amendments to the Act (by the States which have adopted the Act) and the State Forest Acts show that though the provisions made in these Acts are basically the same, some of the State Acts have taken note of the present day problems and made specific provisions for their solution. We have, however, examined two of the State Forest Acts, namely those of Orissa and Karnataka, which show marked re-thinking in some respects.

45.4.8 The main distinguishing features in the Orissa Forest Act, 1972 are as under :

- (i) no claims for shifting cultivation shall be allowed in any forest land notified for 'reservation'. If at all any shifting cultivation is to be allowed, the State Government shall alter the limits of the land proposed for 'reservation', before further action is taken;
- (ii) apart from the enhancement of punishment in reserved and protected forests, the offences in the reserved forests have been categorised into three classes, which have different terms of punishment;
- (iii) for clearing or breaking up of any land in reserved or protected forests for cultivation or otherwise, it has been made obligatory for the Court to order eviction of the offender;
- (iv) whenever any reserved forest or any portion thereof is dereserved by the State Government, it shall, so far as practicable, constitute other lands, equal in areas to the reserved forests so notified, to be a reserved forest;
- (v) village forest may be constituted by the State Government out of any land under its disposal — unoccupied land, communal forests etc., and not out of reserved forest, as provided in the Indian Forest Act, 1927;
- (vi) a special provision has been made for extending the provisions of reserved and protected forests to the forests of princely states merged with Orissa;
- (vii) a provision has been made that an abettor of a forest offence shall be punished with the sentence provided for the offence; and
- (viii) not only all money payable to the Government under the Act or Rules made thereunder, but also all money payable in consequence of contract or agreement for sale by the Government, if not paid by the purchaser when due, shall be recovered as if it were an arrear of public demand (unlike the provisions in the Indian Forest Act, 1927, where all money payable under the Act or Rules made thereunder only are to be recovered as if it were an arrear of land revenue).

45.4.9 In the Mysore (Karnataka) Forest Act, 1963 (and in the Rules made thereunder in 1969) the following distinguishing features appear :

- (i) apart from enhanced punishment, abettor of an offence in a reserved forests can be accorded the same quantum of punishment as an offender;
- (ii) village forests are to be constituted out of any land at the disposal of the Government, and not out of reserved forest;

- (iii) district forests are to be constituted out of any land at the disposal of the Government not included within the limits of any reserved or village forest nor assigned at the survey settlement as free grazing ground or for any other public or communal purposes. Privileges are to be given for removal of forest produce by cultivating *ryots* or other classes of persons for prescribed purposes;
- (iv) protected forests are to be constituted out of an area at the disposal of the Government for placing it under special protection in view of its subsequent settlement and constitution as a reserved forest or for any other purpose;
- (v) there is provision for rule-making power of the State Government for control over reserved trees, and special provisions exist in the Act and Rules for control over sandalwood, rosewood and catechu, whether found on Government or private lands;
- (vi) no land shall be given out for cultivation either within the protected forest or within hundred metres of the boundaries of such forest;
- (vii) special provision has been made for the date palm (*Phoenix sylvestris* Roxb.), palmyra palm - (*Borassus flabellifer* Linn. syn. *B. flabelliformis* Roxb.) and toddy palm (*Carvota urens* Linn.) in district forest;
- (viii) special provision exists for grant of land, out of district forests, for cultivation of coffee or cardamom;
- (ix) sawmilling industries are regulated under the provisions of the Forest Act and the Rules thereunder; and
- (x) power to compound offences has been given to Forest Rangers upwards with realisation of a compensation upto five thousand rupees, instead of fifty rupees only provided for in the Indian Forest Act, 1927.

45.4.10 Other enactments forming part of the general law of the country and having a bearing on forest administration are :

- (i) The Indian Penal Code, 1860.
- (ii) The Cattle Trespass Act, 1871.
- (iii) The Indian Evidence Act, 1871.
- (iv) The Contract Act, 1872.
- (v) The Land Acquisition Act, 1894.
- (vi) The Indian Registration Act, 1908.
- (vii) The Sale of Goods Act, 1930.
- (viii) The Limitations Act, 1963.
- (ix) The Code of Criminal Procedure Act, 1973.

5 THE APPROACH TO FOREST LEGISLATION

45.5.1 A general view ^{1,2} is held that forest law has not been conceived as a positive agent of development, but merely as a means of preventing the misuse of the forest. It has been considered not in terms of its general constructive function, but chiefly in terms of litigation. It has been stated that forest regulations are regulatory and punitive and follow a definite pattern and form. Thus in a typical enactment, clauses constituting various types of forest resources, defining different categories of protection in the forest estate, empowering the Conservator and his officers to do a number of things outside the common law (issue leases, licences and permits, arrest without warrant, compound offences, prohibit the felling and transportation of timber), and defining forest offences and their penalties, were to be found.

45.5.2 According to the revised FAO study, the object of all laws relating to forestry in the modern situation should be the promotion of forestry and forest industries activities so that the forest resources might be utilised for the general economic development of the nation. King² suggests that a more functional a more developmental approach should be adopted towards the forest laws. With this in view, the laws will have to be revised from time to time as socio-economic conditions and technology change. "It may therefore be advisable to frame the present forest law in such a way that its provisions are skeletal, but that it authorises in clear terms a well-defined authority to enact subsidiary legislation, in specific circumstances, by rule, regulation, law or order. Amendments to subsidiary legislation can often be comparatively easily performed, and it is here that the details should be included".

45.5.3 No doubt, the accent in the suggestions of the CBF Sub-Committee, as well as in the two State Forest Acts analysed in paragraphs 45.4.8 and 45.4.9, is on remedial, preventive and punitive aspects of forest law. Only in some respects, they touch the fringe of developmental thinking, e.g. when an Act provides for replacement elsewhere of any part of reserved forest dereserved, or when the responsibilities in, and expectations from, village forests and district forests are distinctly stated, or when industries are sought to be regulated under the Forest Acts, or where the Act provides for proper conservation, regeneration, trade etc. of any particular tree or any class

¹ 1969 Modernising institutions to promote forestry development — where changes should be made — forest legislation. *Unasylva*, Vol. 23 (4), Number 95 : p 40.

² King, K. F S., 1972. A Summary of the Revised FAO Study on Forest Policy, Law and Administration. Rome. FAO.

of produce, such as minor forest produce. But it is largely true that no attempt has been made so far to make the forest law as an instrument of development.

45.5.4 A good example of a functional approach in forest legislation can be found in the Forest Act of the Province of British Columbia, Canada¹. Section 17A of Chapter 153 provides for an earmarked "pulpwood harvesting area", from which pulpwood is to be sold to persons interested in establishing a utilisation plant to utilise the pulpwood from the areas. Section 36(21) again provides: "Such improvements on a licence area as are designed to facilitate the management and operation of, and the growing and harvesting of wood on, any land in the licence area are exempt from taxes under the *Taxation Act*."

45.5.5 Conditions in India are such that there cannot but be a relatively more emphasis on preventive and punitive aspects and enhancement of penalties in any revision of the forest law. We have given thought to the principles which should govern any revision of forest legislation, and we recommend the following to be adopted:

- (i) there should be a uniformity in forest law, so that incompatibility of forest laws among the States is removed and there is no multiplicity of legally sanctioned authorities concerned with forestry matters;
- (ii) it should be possible to tackle specific problems in different parts of the country through subsidiary rules and regulations, where permissible;
- (iii) a developmental approach should be followed; and
- (iv) there should be stringent preventive and punitive provisions, so that when a resource is allocated for development in a certain direction, it is not wasted.

Uniform Forest Law

45.5.6 We have carefully considered the question of having a revised all-India Forests Act *vis-à-vis* amendments to different State Acts. Even though "forests" is a State subject, it is possible to frame an all-India Act for management of the forest lands, under Article 252(1) of the Constitution. The utility of a uniform approach, which is possible only under an all-India Act, can be illustrated by the problems of export of red sanders (*Pterocarpus santalinus* Linn.f.) and of effective steps to control and check smuggling of sandalwood in all the States in the southern zone. These issues were brought before the Central Board of Forestry by both Andhra Pradesh and Mysore (now

¹ 1972. Forest Act (Consolidated for convenience only, July 1, 1972) : pp 1478-79 and 1489. Province of British Columbia, Canada.

Karnataka) at its Eighth meeting in December, 1963. Moreover, there are certain subjects in the Union List in the Constitution which would have a bearing on forest management, particularly in the light of what is contemplated for production forestry, export promotion, soil conservation measures, etc. These are :

- (i) Trade and commerce with foreign countries;
- (ii) Inter-State trade and commerce;
- (iii) Establishment of standards of quality of goods for export or inter-State commerce;
- (iv) Forest based industries, like panel, pulp and paper and rayon; and
- (v) Regulation and development of inter-State river valleys.

45.5.7 Theoretically there could be separate enactments to cover the forestry aspects touching inter-State matters; but difficulties would arise in making such Acts compatible with the provisions of forest laws in different States. For instance, there could be some Central machinery for promotion and control of exports of minor forest produce (MFP); but such machinery cannot work unless it has statutory powers and obligations for planned and economic development of MFP, which might be the concern of the State Acts. Even in matters concerning the States, e.g. licensing of sawmills, there has to be a statutory coordinating authority between neighbouring States, so that there is no scope for conflict about establishing sawmills at the boundaries of the forests of another State. A uniform policy is also to be adopted towards grass and grazing in forest areas. In the Interim Report on Forest Research and Education, we have recommended that the training of officers of the Indian Forest Service, State Forest Services and the Forest Rangers should be a Central responsibility. A uniform legislation for the whole of India would better facilitate teaching of forest law to these higher cadres in forest administration and the development of a common outlook towards the problem of forest conservation, production and development.

45.5.8 We refer to the CBF's recommendation on setting up of coordination committees on two important products — *tendu* (*Diospyros melanoxylon* Roxb.) leaves and rosewood — for coordinating activities of the concerned States in regard to collection, exploitation, transport, marketing, etc. The Centre's role in such matters should be statutorily recognised, as also the need for the States to adopt the same law. This would be possible only if a uniform legislation is enacted permitting the setting up of inter-State coordination committees, which may be imperative for the development of any forest product or a class of products.

45.5.9 We have concluded that an all-India Forest Act would be more purposeful. We, therefore, recommend that there should be an all-India Forest Act enacted by the Parliament. The requisite number of States should be persuaded to authorise the Central Government in this regard under Article 252(1) of the Constitution.

Subsidiary Rules and Regulations

45.5.10 There may be genuine apprehension in the States that an all-India Act would introduce an element of rigidity, which may not meet the special problems concerning forestry in a State. Under Article 252(2) of the Constitution, 'any Act so passed by Parliament (on any of the matters included in the State List) may be amended or repealed by an Act of Parliament passed or adopted in like manner but shall not, as respects any State to which it applies, be amended or repealed by an Act of the Legislature of that State'. It is likely that some of the States would be unwilling to give up their power of amending Forest Acts, whenever considered expedient. It should, however, be possible to frame an all-India Act in such a manner that the States are free to make subsidiary rules and regulations under the Act to meet any special situations. The all-India Forest Act should incorporate uniform procedures, powers and penalties, and provisions for subsidiary rule-making powers. Thus each State would be able to make its rules and regulations to suit its special conditions in such matters as control of reserved trees, nationalisation of trade in a particular produce, constitution and management of social forests, addition to list of 'forest produce', etc. The framing of Act in the above manner would help the States to remove any conflict of forest laws with other relevant laws, i.e. land laws, land tenure system, rules of succession, panchayat raj Acts, etc., which may vary from State to State.

45.5.11 The subsidiary rules and regulations should be framable by State Legislatures. Hence, the following provisions, after Section 103 of the Karnataka Forest Act, 1963 or Section 82(2) of the Orissa Forests Act, 1972, should be made in the 1927 Act:

Every rule made under this Act shall, as soon as may be after they are made, be laid before the State Legislature (or before each House of the State Legislature, where it is bicameral) for a total period of fourteen days which may be comprised in one session or in two or more successive sessions and if during the same period, the State Legislature makes modifications, if any, therein, the rules shall therefore have effect only in such modified form: so however that any such modifications shall be without prejudice for the validity of anything done under the rules.

Developmental Approach

45.5.12 Forest development would have to have more and more statutory backing, because several institutions may have to be created for particular purposes, and these institutions should have the necessary statutory support. Though the existing forest law covers provisions for reservation and protection of land allocated to forestry, there is no direction for making up the areas by the States in place of areas disforested. Furthermore, for development of social forestry, appropriate legislative measures would be needed. The existing law does not provide the needed coverage for developmental purposes visualised in our Interim Report on Social Forestry. To that extent, the scope of the law has to be widened.

45.5.13 There is a provision in the 1927 Act for creation of village forests only out of reserved forests. But this approach did not succeed. We are also not in favour of creation of village forests out of reserved forests, because the latter should better be utilised for productive use elsewhere in the economy. In our Interim Report on Social Forestry, we have recommended several programmes specially to create forests on waste lands belonging to Government and the community and on parts of degraded forest lands, to meet the requirements of the villagers in respect of fuel, small timber, grass and fodder species, etc. We have also indicated therein the steps needed for management and protection of such forests and disposal of produce therefrom. The entire chapter on village forests in the 1927 Act should be suitably adjusted to reflect this approach and provision should be made for making subsidiary rules and regulations by the States to manage these 'social forests'.

45.5.14 Forest raw materials for industries are virtually a monopoly of the Government, and as such it should be relatively easy for the Government to create and allocate the resources for the development of particular types of forest industries needed in the national economy. At the national level, estimates of demand of the total supply of forest resources including imports and the total demand including exports have to be made, as a pre-condition for planning the development and allocation of forest resources for different industrial uses. For instance, the planned development of industries like pulp and paper and panel products would require carving out beforehand of an industrial catchment, which may transcend the borders of the States. Some regional authority may have to be created for taking measures for implementing any project concerning an industrial catchment through production, infrastructure development, setting up of industries, marketing, etc. Statutory support would be needed for creation of these regional bodies and for endowing them with necessary powers.

The States would also require statutory powers to control the establishment and working of sawmilling industry near the forests with a view to stopping conversion of logs unauthorisedly removed from the forests. Required provisions in these respects should be made in the revised all-India Forest Act.

45.5.15 In our Interim Report on Production Forestry — Man-made Forests, we have recommended that forest development corporations may be set up for taking up production forestry. Many States have already set up such corporations. As per our recommendations in the Interim Report, the States have transferred forest areas to the corporations for development of these forests on commercial principles. Protection of these forests as also all other functions to be performed for realising the objectives of the corporations would have to be carried out by the corporations, and for that purpose they would require a statutory backing. Provision should be made in the revised all-India Act for the delegation of necessary powers of forest officers to specified employees of the corporations. While details can be prescribed in the subsidiary rules and regulations, the Act should include the required provision for delegation of rule-making powers. It is also possible to make the necessary provision in the Act, with indications of the authority to make subsidiary rules and regulations, to deal with the question of nationalisation of trade in MFP and of the sandalwood oil industry. We have already mentioned while analysing the Karnataka Forest Act 1963 in paragraph 45.4.9 that special provision exists for rule-making powers of the State Government for control over reserved trees, and over sandalwood, rosewood and catechu, whether found on Government or private lands.

45.5.16 For forest development, investment incentives would have to be provided for, though they would not come within the purview of the forest law. Incentives in the form of tax-free period, tax rebate, drawbacks, reduced power tariff, etc. are at present allowed for industrial development in backward areas, and forest industries may benefit from it. There is a whole range of forestry activities that may not appear, in a legal sense, to be directly connected with the final stages of conversion of crop into products. Some of the instances are: (a) establishment of man-made forests, (b) logging, (c) wood storage, seasoning and preservation, and (d) wood distillation. As recommended by us in our Interim Report on Production Forestry — Man-made Forests, State forest corporations may be formed to undertake many such activities; and already some States have set up such corporations. Even when undertaken by the Forest Department directly, some concessions may have to be given to stretch the available funds. Provisions for such incentives would mostly have to be made in other laws,

and their necessity has been indicated by us in Chapter 42 on Production and Social Forestry.

45.5.17 In Chapter 41 on Forest Policy, we have recommended* that no disforestation should be permitted without the approval of the State Legislatures. We have also stated that it is of utmost importance that there should be a minimum diversion of forest lands for other purposes and recommended that where some diversion does become inevitable, an attempt should be made to make up the loss by bringing some other areas under forests. Our recommendations apply to all classes of forests — reserved, protected or unclassified. A provision on the above lines should be made in the revised all-India Forest Act.

Preventive and Punitive Provisions

45.5.18 Though the Indian Forest Act, 1927 does not prohibit action under the Indian Penal Code, 1860, the underlying idea in enacting a special law for forest offences was to make the Act as far as possible a self-contained code for dealing with them. Hence, the following points may be considered while drafting the revised all-India Act :

- (i) receipt of stolen timber and other forest produce and abetting the commission of a forest offence is not at present punishable under the Act. The provisions of Sections 27(1)(d), 27(2)(a) and 84 of the Kerala Forest Act, 1961, Section 85 of the Orissa Forest Act, 1972 and Section 24 of the Karnataka Forest Act, 1963 may be incorporated in the revised all-India Act, and
- (ii) provision does not exist in the Act for dealing with a situation when a forest officer is obstructed in the discharge of his duties, while dealing with the accused or the seizures in a forest offence. The provisions of Section 24 of the Cattle Trespass Act, 1871 and Section 46 of the Land Acquisition Act, 1894 may be examined for incorporation.

45.5.19 There are circumstances when a forest offence may also constitute an offence under the Indian Penal Code or under other laws. The punishment provided for the offences under the latter Acts may be more deterrent for which reason it may be considered desirable to take action under these Acts. A specific provision should, therefore, be made on the lines of Section 78 of the Karnataka Forest Act, 1963 or Section 74 of the Orissa Forest Act, 1972, which reads as follows:

“Nothing in this Act shall be deemed to bar the prosecution of any person under any other law for any act or omission which constitutes a forest offence or from being liable under such other

* Paragraphs 41.5.15 and 41.6.5.

laws to any higher punishment or penalty than that provided under this Act or the rules thereunder; Provided that no person shall be prosecuted and punished for the same offence more than once."

45.5.20 Usually Range Forest Officers or Deputy Rangers/Foresters assist in the prosecution in most of the forest cases. Under Section 302(1) Cr.P.C. 1973, prosecution can be conducted by any person other than a police officer below the rank of an Inspector with the permission of the Magistrate inquiring into or trying the case. It is suggested that Range Forest Officers could be authorised to conduct such prosecutions before the Magistrate. Necessary amendment on the lines of the provision existing in Section 24 of the Police Act, 1861 can be considered.

45.5.21 The scope and extent of application of the 1927 Act as set out in Section 1 of that Act would have to be amended with reference to the changes brought about by the formation of new States and reorganisation of the old ones. There is a suggestion for the amendment of the definitions of terms and inclusion of other items under 'forest produce'. It would be sufficient to so define this expression as to leave room for State to State variations.

45.5.22 In respect of land notified under Section 4, declaring the Government decision to constitute such land a reserved forest, it is necessary to make provision for prohibition of cutting of trees, building of houses, granting of patta and kindling of fires. Entertainment of suits for claims to rights in the notified area may also be barred as has been done under Section 5(2) of the Orissa Forest Act, 1972. However, acts done with the permission of the Forest Settlement Officer should be exempted from such prohibition. At present, there is no specific provision in the 1927 Act as to how claims to rights of way and to water course are to be settled by the Forest Settlement Officer. This omission needs to be remedied, by incorporating a section, as in Section 12 of the Orissa Forest Act, 1972.

45.5.23 The 1927 Act does not contain provisions empowering the forest officers to secure eviction of unauthorised occupants in reserved or protected forests. A new sub-section (4) added to Section 26 of the 1927 Act in Maharashtra and Gujarat empowers a forest officer not below the rank of a Ranger, a police officer not below the rank of a Sub-Inspector and a revenue officer not below the rank of *Mahalkari* to evict from the forest land a person convicted under Section 26(1)(d) or (h). Similar provisions exist in Madhya Pradesh amendment in Section 80(A), and in Section 20(3) of Andhra Pradesh Forest Act, 1967. The Orissa Forest Act, 1972 also provides under Sections 27(4) and 37(2) that 'the court shall order eviction of the offender' in reserved or protected forests. The present socio-political

compulsion may make a statutory provision largely unreal, where land for the agricultural population is concerned. Accordingly, a general statutory provision for a forest officer to take action for eviction would only create difficulties for him. Instead the proposed all-India Act should provide for the contingency that any person convicted by a court for unauthorised occupation of reserved or protected forest land shall be 'liable for eviction'. The rules would provide for the details, but the indication of the machinery for eviction should be given in the Act.

45.5.24 Under Sections 53 and 54 of the 1927 Act, a report regarding the property seized in a forest offence has to be made to the Magistrate concerned, who has to take necessary action for the disposal of the seizure. But in practice the Magistrate rarely passes any order on the property seized in respect of offences that are disposed of by compounding. In line with sub-section (2) of Section 44 of the Andhra Pradesh Forest Act 1967, the 1927 Act may be modified to provide that if the offender agrees in writing to get the offence compounded, a report regarding the seizures need not be made to the Magistrate and disposal of the seizures is excluded from the jurisdiction of the Magistrate.

45.5.25 The 1927 Act may be amended to substitute the word 'vehicles' for 'carts' occurring in the section dealing with seizure of property liable to confiscation. Regarding sale of perishable seizures, Section 48 of the Andhra Pradesh Forest Act, Section 46 of Tamil Nadu Forest Act and Section 58 of Kerala and Rajasthan Forest Acts authorise the officer seizing the property to sell the property himself if, in his opinion, it is not possible to obtain the orders of the Magistrate. This production should be made in the 1927 Act, but the orders of the Magistrate regarding sale of seizures would have to be obtained in respect of non-compoundable offences.

45.5.26 It appears that Section 82 of the 1927 Act regarding recovery of money due to Government is not comprehensive enough to require reimbursement, to the Government by the previous purchaser of timber or other forest produce, of the loss incurred in a re-sale. It is also desirable to bring within the scope of this section the compensation and value of the seized or confiscated property undertaken to be paid under Section 68 of the 1927 Act. The amendments by Madhya Pradesh and Himachal Pradesh and the Acts of Orissa, Maharashtra and Gujarat may be incorporated in Section 82 of the 1927 Act.

45.5.27 Enhancement of the penalties should be provided for, due to the following reasons :

- (i) the punishment provided at present is nominal and it has no deterrent effect;

- (ii) at least some offences should be made cognisable and non-bailable, as well as triable by Magistrate I/II Class. As per columns 4 & 5 of Part I of the First Schedule to the Cr.P.C. 1973, if the offence is punishable with imprisonment for one year and more but less than three years, it is triable by a Court of Sessions/Presidency Magistrate/Magistrate I Class/II Class; and
- (iii) offences committed under aggravated circumstances call for greater punishment.

45.5.28 The Orissa Forest Act, 1972 categorises offences in a reserved forest for different scales of punishment as below:

- (i) Clearing or breaking of land after notification under Section 4 for constitution of reserved forest, and kindling or carrying fire — imprisonment for six months or fine upto five hundred rupees or both.
- (ii) Trespassing or pasturing cattle, and causing damage to forests while felling or removing timber or any produce — fine upto one thousand rupees in addition to compensation for the damage to the forests.
- (iii) Felling or damaging etc. any tree or any forest produce, quarrying stone etc. or removing any forest produce, clearing or breaking up etc. of any land for cultivation or attempting to cultivate and illegal hunting, shooting etc. — imprisonment upto two years or fine upto five thousand rupees or with both.

In the case of offences in protected forests, the punishment prescribed is imprisonment upto one year or fine upto two thousand rupees or with both, in addition to compensation for the damage to the forests.

45.5.29 We are of the view that punishment should be more than what is provided for in the 1927 Act for ordinary forest offences, but provision for the award of enhanced punishments may be considered for the offences committed under aggravated circumstances as detailed below :

- (i) offences during the night;
- (ii) when the offence is committed within a year of previous conviction for the same (or greater) offence;
- (iii) when the offender is a right-holder;
- (iv) when the offence is committed after preparation for resistance to lawful authority; and
- (v) offender continuing the offence after being warned against it.

45.5.30 There should be a provision for awarding more stringent punishment for the more serious types of offences also, like tampering with boundary pillars, putting of counterfeit marks on trees or timber, and clearing or breaking up of any reserved or protected forest land

for cultivation or for any other purpose. Offences concerning reserved trees, like sandalwood, rosewood, etc., or reserved forest produce, e.g. any item of MFP, trade or industry in which may be nationalised, should be considered as serious types of offences.

45.5.31 We have recommended in paragraph 45.2.9 that wilful damage to a forest by setting fire to it should call for an enhanced punishment. The other points that we have made therein should also be provided for in the revised all-India Act.

45.5.32 Power of forest officers to arrest without warrant already exists in the 1927 Act. It should be circumscribed by a clear definition of the arresting authorities' responsibilities. The following provisions, after Section 74 of the Karnataka Forest Act, 1963 and Section 68 of the Orissa Forest Act, 1972, should be made in the revised all-India Act :

- (i) any Forest Officer or Police Officer may, without orders from a Magistrate and without a warrant, arrest and detain in custody any person if the officer knows or has reason to believe that such person is committing or has committed any forest offence or if such person refuses to give his name and residence, or gives a name or residence which there is reason to believe to be false or if there is reason to believe that he will abscond; and
- (ii) every person arrested and detained in custody under this section shall be informed, as soon as may be, of the grounds for such arrest and shall be produced before the nearest Magistrate having jurisdiction in the case within a period of twenty-four hours of such arrest excluding the time necessary for the journey from the place of arrest to the court of the Magistrate and no such person shall be detained in custody beyond the said period without the authority of a Magistrate.

45.5.33 Regarding bonds executed under Section 85 of the 1927 Act, it should be provided that the Divisional Forest Officer (or Deputy Conservator of Forests) should be the competent authority to decide whether there has been any breach of any of the provisions of the bond and if so, by whom and as to what amount should be paid for such breach. The decision of the DFO in this regard should be made final. The Act is silent on these points.

Revision of All India Act

45.5.34 In view of the changes recommended in the basic approach towards forest legislation and a great many drawbacks pointed out in the regulatory and punitive provisions in the existing all-India Act (the Indian Forest Act 1927), a revised all-India Act should be

framed, instead of amending the 1927 Act. The task of drafting the revised Bill should be entrusted to the Central Forestry Commission, which would also review from time to time the need for special legislation or provisions in other related Acts. Attempts should be made to evolve a consensus in the Central Board of Forestry on a suitable draft.

6 SUMMARY OF RECOMMENDATIONS

45.6.1 Some of the more important recommendations are given below :

1. Record of forest fires should be maintained by all the States under a uniform classification by types and causes as per proforma prescribed in Appendix 45.1, with a view to planning fire prevention measures.

(Paragraphs 45.2.3 to 45.2.5)

2. Voluntary associations should be organised with local leadership to support administrative measures for protection of forests from fire.

(Paragraph 45.2.8)

3. Letters of appreciation and cash rewards should be granted to local *panchayats* and voluntary associations in fire-prone areas for their fruitful cooperation and assistance.

(Paragraph 45.2.8)

4. Publicity for protection of forests from fire should be ensured both among urban and rural groups of population, particularly by an imaginative use of the audio-visual medium.

(Paragraph 45.2.8)

5. There should be a provision for the award of enhanced punishment in the case of wilful fire damage to a forest. Provision for summary trials of offences relating to forest fires may be made either by appointment of special magistrates or by investing gazetted forest officers with magisterial powers. In case of repeated man-caused fires, the Government may suspend rights and privileges of the community in the locality.

(Paragraph 45.2.9)

6. A network of lookout stations should be built. The practice of engaging local people for detection and suppression of forest fires should be widely adopted, but the employment should be related to performance.

(Paragraph 45.2.11)

7. A reliable communication and transport system should be built up for fire control. Main roads, subsidiary roads, inspection paths, etc. should be so planned that they become part of a well-planned system

of fire-breaks/fire lines. The benefit accruing due to fire protection should be included for determining the cost-benefit ratio of road projects.

(Paragraph 45.2.12)

8. Fuel condition for a particular forest area in the form of maps should be prepared for all fire-prone areas previously identified. The maps should show the probable rate of spread of fire and resistance to control. The concept of "fuel types", to guide the mapping, should be developed by the Forest Research Institute, Dehra Dun.

(Paragraph 45.2.14)

9. There should be well planned fire protection organisation in the States, particularly in those having fire-prone forest areas. Specifically, it would be necessary to develop an efficient system of fire protection to safeguard the investment in man-made forestry.

(Paragraphs 45.2.15 and 45.2.18)

10. Training programmes in fire detection, prevention and suppression should be arranged for all levels of field officers.

(Paragraph 45.2.16)

11. Research on various topics concerning forest fires should be properly organised. A research project involving the States having fire-prone areas should evolved and centrally coordinated by the Forest Research Institute, Dehra Dun.

(Paragraph 45.2.17)

12. *Nistar*, i.e. the rights and privileges in forests, should be regularised in such a manner that on the one hand the deserving people get their essential requirement conveniently and at reasonable rates, and on the other the productivity of the forests is maintained. Wood/bamboos should be supplied after treating them with preservatives, which would result in their distribution at longer intervals.

(Paragraphs 45.3.15 and 45.3.21)

13. All unclassed and protected forests should be constituted into reserved forests at the earliest possible, in order that *nistar* could be extinguished as far as possible in the manner provided in the forest law.

(Paragraph 45.3.16)

14. Large scale social forestry programme should be taken up in such a way as to make it possible to meet the needs of rural people for forest produce from readily accessible area and thereby decrease the burden on production forestry.

(Paragraph 45.3.17)

15. The villagers should not be allowed to collect *nistar* themselves from the forests. Insted, *nistar bhandars* (depots) may be established at convenient places by the Forest Departments for meeting the bonafide requirements of the people, and a charge to include

the cost of production, transport, depot charges as also a nominal profit should be made. Ultimately *nistar* should be abolished. The system of commutation, known as *nistar* cess, should also be abolished.

(Paragraph 45.3.18)

16. Where necessary as an interim measure, as far as possible separate areas of forests should be set aside for meeting the *nistar* demand. Association of *panchayats* for protection of *nistar* forests should be secured. Once *nistar* forests are demarcated, no rights and privileges should be allowed in forests reserved for production forestry and for conservation of nature or environment.

(Paragraph 45.3.19)

17. Where disforestation takes place, *nistar* rights should be proportionately abolished.

(Paragraph 45.3.20)

18. Wherever the *nistar* demand is acute, wasteland available nearby should be utilised for producing fuel and hay as also other products considered indispensable by the *nistaris*.

(Paragraph 45.3.20)

19. For logging as well as for other forest works, a representative of the village institution (*panchayat*) should be associated when payments to workers are made.

(Paragraph 45.3.24)

20. To protect the forests from destruction and unauthorised encroachments, more employment opportunities should be created in forest operations and for that purpose sufficient funds should be allocated for forest development.

(Paragraphs 45.3.25 and 45.3.26)

21. There should be an all-India Forest Act enacted by the Parliament for the sake of uniformity. It should be possible to frame the Act in such a manner that the States are free to make subsidiary rules and regulations under the Act to solve any special situations.

(Paragraphs 45.5.6, 45.5.9 to 45.5.11)

22. The provisions for creating 'village forests' in the Act should reflect the approach regarding creation of forests on wastelands belonging to Government and the community and on parts of degraded forest lands, to meet the requirement of the villagers. Subsidiary rules and regulations to manage these 'social forests' should be made by the States.

(Paragraph 45.5.13)

23. There should be provision in the Act for setting up a national/regional agency for rational use of forest resources, both internally and for export.

(Paragraph 45.5.14)

24. There should be a provision in the Act that no disforestation should be permitted without the approval of the State Legislatures and the where some diversion of forest lands for other uses becomes inevitable an attempt should be made to make up the loss by bringing some other areas under forests.

(Paragraph 45.5.17)

25. A revised all-India Act should be framed, instead of amending the Indian Forest Act, 1927. Attempt should be made to evolve a consensus in the Central Board of Forestry on a suitable draft, to be prepared by the Central Forestry Commission.

(Paragraph 45.5.34)

APPENDIX 45.1 (contd.)

1	2	3	4	5	6	7	8	9	10
(c) due to carelessness of passers-by									
(d) originating from fire in bordering agricultural fields									
(e) Originating from burning of fire-lines by Forest Department . .									
(f) Due to other causes									
III. Deliberate/intentional/incendiary due to man									
(a) for inducing growth of grass in natural grasslands, scrub forests, etc.									
(b) enmity with forest staff									
(c) setting fire for catching wild animals									
(d) originating from malice									
(e) originating at the time of collecting MFP, like honey, mahua flower, etc.									

NOTE: The above proforma should be used to keep a record of the fire damages in a State. While incorporating in the Annual Reports or in the Indian Forest Statistics, however, columns 2 & 4 should be omitted, and instead the total number of fires and damage thereby should be reported separately for natural and man-made forests, categorised into different types. In the remarks column an analysis should be made about the location and month of occurrence of the maximum damages by fire.

APPENDIX 45·2

(Paragraph 45·2·6)

Record of Fire in Different States and Union Territories in India for the periods 1960-61 to 1964-65 and 1968-69 to 1972-73

State/Union Territory	Average for 1960-61 to 1964-65			Average for 1968-69 to 1972-73		
	number of fires	area burnt	recorded value of damage	number of fires	area burnt	recorded value of damage
	No.	ha.	Rs.	No.	ha.	Rs.
Andhra Pradesh	321	25,280	neg	275	68,878	NA
Assam	20	28,772	NA	6	127	96,900
Bihar	572	42,975	NR	445	15,660	NA
Gujarat	410	15,684	NR	400	29,620	13,323
Haryana	..	..	..	40	2,440	20,780
Himachal Pradesh	*	7,422*	35,520*	447	21,898	8,86,00,000
Jammu & Kashmir	274	5,980	NR	527	14,527 ^a	37,512 ^a
Karnataka	NA	NA	NA	NA	NA	NA
Kerala	31	1,586	NR	NA	999 ^a	NA
Madhya Pradesh	1,260	58,899	26,500 ¹	NA	NA	NA
Maharashtra	1,192	52,781	19,580	NA	NA	NA
Manipur	NA	NA	NA	NA	NA	NA
Meghalaya	—included in Assam—			1	11 ^a	455 ^a
Nagaland	NA	NA	NA	NA	Neg	Neg
Orissa	272	107,905	neg	550	50,988 ^a	55,20,000
Punjab	223**	9,522**	71,980**	41	2,220	77,343
Rajasthan	450	72,107	NR	NA	NA	NA
Tamil Nadu	600	68,801	NR	NA	NA	NA
Tripura	16	79	NR	33	293	26,590
Uttar Pradesh	666	35,014	41,460	614 ^a	50,792	NA
West Bengal	100	1,368	6,407 ^a	34 ^a	288 ^a	130 ^a
Andaman & Nicobar Islands	Nil	Nil	Nil	Nil	Nil	Nil
Arunachal Pradesh	Nil	Nil	Nil	Nil	Nil	Nil
Dadra & Nagar Haveli	NA	NA	NA	12 ^a	286 ^a	415
Mizoram	NR	NR	NR	NR	NR	NR

* For Himachal Pradesh territory before Punjab reorganisation.

** Punjab included the present Haryana and parts of Himachal Pradesh at that time.

¹ Only recorded for 1963-64.² Average for 3 years only.³ Average for years, excluding 1972-73. Estimated value of damage reported for one year only, 1971-72.⁴ Average for 4 years.

neg — negligible.

NA — not available.

NR — not recorded.

Sources : (1) Forest Research Institute, Dehra Dun for the years 1960-61 to 1964-65.

(2) Chief Conservators of Forests for the years 1968-69 to 1972-73.

APPENDIX 45.3

(Paragraph 45.3: 12)

An illustrative Note on the Incidence of Rights and Privileges in Orissa Forests brought under Government Ownership in Stages*

The lands contained within the present boundaries of State forests in Orissa belonged to three categories prior to integration :

- (i) The Government-owned forests under the management of Forest and Revenue Departments of the erstwhile province of Bihar and Orissa at the time of Independence.
- (ii) The forests of the ex-princely states of the Eastern States Agency, which merged with Orissa on January 1, 1948.
- (iii) The forests of *ex-zamindars* either under the princely states or the State Government, which vested in the Government in the early fifties.

The legal position of the forests thus remained fluid for some time, till it stabilised as a result of promulgation of, firstly, the Indian Forest (Orissa Amendment) Act, 1954 and then, finally, the Orissa Forest Act, 1972. The rights and concessions vary widely from area to area; and the extensiveness or otherwise of rights and concessions depended more or less on the category to which the forests belonged.

2. The government-owned forests at the time of Independence were governed by the Indian Forest Act, 1927, except in the districts of Ganjam and Koraput and the Balliguda and G. Udayagiri taluk of Phulbani district, where Madras Forest Act, 1862 was applied. Different classes of forests that came to be constituted were: Reserved forests, Demarcated Protected forests, Undemarcated Protected forests, Reserved lands and Unreserved lands. Forests in this group comprised four forest divisions — Angul, Puri, Sambalpur and Ganjam. In Angul, Puri and Sambalpur divisions, classification of forests as 'A' class and 'B' class existed, till Orissa Forest Act, 1972 was formulated. No rights were recognised in the 'A' class reserved forests of Sambalpur and Puri divisions, but in Angul division certain rights were recognised in respect of fuelwood and minor forest produce. Free grazing was allowed in Angul division. Bamboo was allowed at concessional rates to the tenants and professional basket makers.

3. From the 'B' class reserved forests and demarcated protected forests, tenants used to get their requirement of timber and fuelwood from coupe contractors at concessional rates in Angul division. They were also allowed bamboos at concessional rates from coupes. There was no demarcated protected forests in Sambalpur division but the tenants of Puri division had the right to collect free of cost green timber of unreserved species and dry timber of all species except *sal* and *sissoo*. Same was the case with fuelwood. Bamboo was free for the tenants also. In the case of unreserves, timber and fuelwood of 'unreserved' species and bamboo were free, but timber of 'reserved' species was allowed at concessional rates. There were, however, restrictions on free removal of certain MFP.

* Based mainly on the Report of the Forest Enquiry Committee, Orissa, 1959.

4. In the reserve forests of Ganjam division, where the Madras Forest Act was in vogue, no rights to forest produce except those admitted to the *kandhas* (a tribal group) were allowed. In the 'unreserves' concessions admitted in general to local tenants were for free removal of timber, dry fuelwood, bamboos and MFP for their domestic use. Free grazing was also allowed.

5. Regarding the forests of the ex-princely states, each had its own rules and regulations. Some of these states also framed their own forest Acts. Through the 1954 amendment of the Indian Forest Act, 1927, all such rules and regulations were declared to be deemed to have been framed under the Indian Forest Act. Thus there were different rules in the different erstwhile princely state areas under the same Act. The previous classification of 'A' reserves, 'B' reserves and *khesra* forests was abolished. The 'A' and 'B' reserves were all declared to be reserved forests, and the *khesra* forests as protected forests. The *khesra* forests have different names in different localities — *sadharan* forest, *katra*, *krishi* or *gramya* jungles or unreserves. No right exists in the reserved forests which were previously 'A' reserves, except the concession of free removal of certain minor forest produce for domestic use only. Though 'reserved' at present, rights exist in the previous 'B' reserves, usually consisting of free removal of unreserved species and minor forest produce, removal of reserved species at one-fourth or half royalty rates, removal of bamboos free or at concessional rates, free grazing, etc. The *khesra* forests, as the different aliases suggest, are burdened with rights and privileges.

6. Some of the ex-*zamindari* forests, like Jeypore, Parlakimedi, etc., were administered under rules framed under the Madras Forest Act, 1882. In some, rules and regulations were framed without the authority of any Act. In some others again, the forests were differentiated into 'reserved' and 'protected' forests, but such a classification in ex-*zamindari* areas had no legal sanction. As in the case of erstwhile princely states, some species were classed as 'reserved' species. No rights were admitted generally in reserved lands, except for free removal of fuelwood, bamboo and some minor forest produce. Grazing was free in the unreserved and protected lands, and at concessional rates in 'reserved' lands.

7. Payment of *nistar* cess or forest cess by the tenants of the erstwhile princely states is a special feature of the 'B' reserves and *khesra* forests, which belonged to these states. *Nistar* cess is a commutation of payment to be made by the tenants for free use or use at concessional rates of timber and other forest produce from these forests. There is no system of *nistar* cess in any of the forests of ex-*zamindars* or those which were directly under the provincial administration just before Independence. The only exception in the latter category is the protected forests (demarcated and undemarcated) of Khurda (Puri division). The rate assessed was either based on land revenue (between 3 to 13 per cent of land revenue) or based on area of cultivated land held by the tenants (Rs. 0.01 to Rs. 0.10 per hectare). No limit was fixed on the quantity of produce allowed to be removed in lieu of the cess paid. Only in one ex-princely state, the rules provided that the royalty of the produce allowed to be removed should not exceed six times the annual cess. The improvidence of the cess payers has resulted in denudation of *nistar* forests, and the

denuded condition of the forests in turn has given rise to a clamour for non-payment of these cesses. On the other hand those in the neighbourhood of well-wooded areas are enjoying the concessions too much in comparison with what they pay. A Standing Committee on Forestry set up in 1951 by Orissa Government sought to control removal of produce against payment of *nistar* cess. Even then the scale of removal allowed was far in excess of the value of the produce. For instance, it was recommended that tenants paying *nistar* cess upto Rs. 1.00 should be allowed to remove :

(a) materials free of royalty each year —

(i) timber about 0.10 m³.

(ii) fuelwood — six cart-loads,

(iii) brushwood and thorns — two cart-loads,

(iv) one long about 8 m long and 40 cm girth; and

(b) material at half-royalty each year — bamboos about three cart-loads of 100 each.

In addition, other building materials were to be allowed at half the rates of royalty.

8. There are other kinds of rights and privileges affecting forest management in all categories and classes of forests. Landless people who eke out a living by sale of fuelwood and bamboos are usually allowed to remove from forests such materials for sale. The Scheduled Tribes and Scheduled Castes are usually allowed special concessions, considering that they are economically backward. In some forests, professionals like basket makers, *kamars* (black-smiths) and *kumbhars* (potters) are allowed to take their requirement of forest produce on payment of an annual tax or fee. People owning only homestead land usually pay cess at the rate of Rs. 0.25 to 0.50 per house to enjoy the privileges of getting all their requirement of forest produce. In Kalahandi, the agricultural labourers pay a fuel cess, enabling them to enjoy free use of fuelwood.

9. The Orissa Forest Act, 1972 at present covers all the forests under the Government control from whatever sources they might have come under the Government. So far as the forests of erstwhile princely states are concerned, a special provision has been made that all 'reserves' of the merged states should be considered as reserved forests under the Act, and all other classes of forests as protected forests. The rights and privileges are not affected. Only in the case of reserved forests there is a bar to the accrual of forest rights, except by succession or by a grant.

FOREST PLANNING, RESEARCH AND EDUCATION

1 INTRODUCTION

46.1.1 The forest inventory aims at giving the basis for drawing a long term plan of forestry activities. The present practice of taking stock of the resources as provided for in the working plans is not adequate enough. A National Forest Information System is required to be built up, and we have suggested steps to be taken in this direction.

46.1.2 It is felt that although procedure and standards have been prescribed to record the production statistics, yet the maintained figures lack accuracy. The figures on the forest area obtained from different sources show a discrepancy which creates difficulties in planning. In this chapter, we have also looked into the need for cost and price studies in respect of forest produce, as well as for developing a more reliable base for estimating national income accruing from the forestry sector. Data on labour employment in forestry activities and in forest industries are inadequate for proper planning.

46.1.3 The planning in forestry had so far little relation with the end product. The national requirement of wood and other products and services would have to be translated into growth goals. The planning should aim at providing and delivering to the users the forest raw materials and services as per the set national growth goals. The concept of area management would thus have to be replaced by production oriented plans. Planning would be required to be done at three levels, national, State and project, and the plans should present a composite picture of production aimed at. We have examined in this chapter the steps to be taken up for planning on these lines.

46.1.4 The existing organisation at the Centre and in the States for dynamic forest development planning being inadequate, we have suggested strengthening of the organisation, and we have defined the complementary roles of the Central and State organisations.

46.1.5 We submitted an Interim Report on Forest Research and Education in June, 1974 for completely reorganising and reorienting

forest research and education. We have stressed therein the imperative need for involving the universities in forest research and education and for organising research and education in such a way that an autonomy in the conduct of forest research and education is possible in course of time. In this chapter, we have only pointed out some of the problems requiring immediate attention in research and in extension of research results in the field. We have more particularly drawn attention to the need for a revised plan of in-service education and training, in order that the trained manpower in the required direction is available for the development of forestry.

2 FOREST INVENTORY

46.2.1 The objectives of forest inventory are to collect, analyse and provide adequate data at different levels — national, regional, State and local — for policy making in the sectors of forest and forest industries. Forest inventory thus aims at giving the basis for long term planning of forestry activities.

46.2.2 A wealth of resource and resource-oriented information already exists in India in the form of forest working plans, census reports, industrial output statistics, soil survey reports, etc. However, most of this information is not readily retrievable, lacks uniformity and is difficult if not impossible to summarise for use in the planning for forest development. This study of existing available information is an essential first stage in an inventory. It is then possible to design inventory procedures to provide the information wanted to the desired limits of reliability.

46.2.3 From a national standpoint it appears that definite action is needed to ensure that in future all information collected for working plans etc. can be readily aggregated for national inventory and planning purposes. This means that a common set of definitions, terminology, measurement units and standards should be developed and agreed on at all levels. In the long run information collected for working plans etc. must be suitable for input into national studies. In the following paragraphs, we discuss the existing situation in forest inventory and our suggestions for the future.

Status of Pre-Investment Survey of Forest Resources

46.2.4 The Pre-Investment Survey of Forest Resources (PIS) during UNDP/FAO collaboration completed a survey of forest areas of about 29,800 sq km. Subsequently, 85,000 sq km were surveyed by the PIS during the Fourth Plan. The scope of the PIS is confined

to finding out the industrially utilisable surplus forest resources for industrial development in a previously identified industrial catchment. The survey results thus provide basic information for planning expansion capacities or new industries based on the raw material surplus in the surveyed areas.

46.2.5 The PIS studies take into account only limited developmental potential of previously identified areas based on existing information. We are of the view that a survey on the national scale of a more generalised nature should be a precondition for deciding priorities for the selection of areas for detailed pre-investment studies. In the draft Fifth Five Year Plan, the present PIS organisation is proposed to be converted into 'National Forest Survey' for carrying out regular, periodical and comprehensive forest resources surveys. The programme will include computation of forest growing stock, increment and potential increment in different forest tracts, divisions, natural regions and States, and also evaluation, coordination and monitoring of forest development programmes.

Present Status of Other Inventory Practices

46.2.6 The information regarding existing forest growth or growth potential in forest lands is inadequate. This gap in information is a handicap in preparing objective production plans in the forestry sector. Historically the forests in India, being residuary lands, have usually poorer infrastructure in the form of roads and other communications than the national average. Complete lack of statistics about inaccessible forest resources is a major gap in our information.

46.2.7 The forests in India are of three major types, viz., coniferous, deciduous and the evergreen. The latter two types have a large number of species with different qualities of wood. Research in the utilisation of most of the wood is not sufficient to find commercial uses for them. The economic benefits of forestry in the rural economy as a source of employment and raw material are still to be fully assessed to make an impact on the management policies of the forest lands in relation to the local people. Lack of such a socio-economic study is perhaps another gap which comes in the way of planned development.

46.2.8 The information as to how far existing forest management is adequate for conservation of soil and water resources is incomplete. Forest survey should bring out the detailed position in this respect. Mention may be made of the fact that there has been an inadequate survey and evaluation of plantations. About 2 million hectares of man-made forests were created in India upto 1972. Although a number of State Forest Departments have tried to carry out evaluation

of this work from time to time, survey and evaluation base for this important national programme has been inadequate. There is a serious backlog in the preparation of forests flora, and an intensive organisation and increased efforts are necessary to clear this backlog.

46.2.9 Appropriate forest maps on scales suitable according to the intensity of management are essential for the management of forest resources. For this, State Forest Departments depend on the Survey of India. Mapping of forest soil is required to be done in order to realise its full potential in the creation of new resources, particularly in the man-made forestry programmes. For the purpose of inventory and planning, besides aerial photographs, the following types of maps are necessary: (a) topographical maps, (b) working plan maps, (c) soil maps, and (d) special maps.

46.2.10 The smallest size of topographical maps is generally in the scale of 1 : 50,000. Some of the published sheets are out of date. It is essential not only to publish all the remaining sheets, but also to ensure that these maps are kept reasonably upto-date. For working plans, particularly in areas where fairly intensive forest management is being practised, it is necessary to have maps of 1 : 15,000 or 1 : 25,000 scales. For this purpose, the Survey of India has been carrying out special forest surveys for the various State Forest Departments, for which contributions are received by the Survey of India. According to a communication from them in October 1971 to the Forest Research Institute (FRI), Dehra Dun, the reserved forest area surveyed so far is only 13,935,000 hectares in the scale of 1 : 25,000 or larger.

46.2.11 Aerial photographs have assumed a great importance particularly in the initial stages of forest inventory. With the exception of comparatively smaller areas, major portion of the country is covered by aerial photographs in 1 : 50,000 to 1 : 60,000 scales. A small part of the country only is covered on 1 : 32,000 to 1 : 40,000 or 1 : 15,000 to 1 : 20,000 scales. For normal forest management purposes, aerial photographs on 1 : 50,000 scale would suffice. In areas of special interests and for those intensively managed or under man-made forests, aerial photographs on 1 : 20,000 scale would be appropriate. The aerial photographs to be useful for forest inventory work should be taken at the appropriate time of the year, when the trees are in leaf. Space photography from Indian scientific satellite being launched by the Department of Space should also be used for rapid forest survey in areas which are little known.

46.2.12 In recent years some State Forest Departments have carried out detailed soil surveys. It is necessary to carry out this work comprehensively in future in order to prepare soil maps for forest areas, so that creation of new resources can be properly

planned. In our Interim Report on Forest Research and Education, we have recommended that the survey of forest soils in the States should be one of the activities of the State forest research organisations. We have also recommended that collaboration with the All-India Soil and Land Use Survey Organisation and coordination with the State coordination committees for soil survey and the Central forest research organisation would be necessary in the matter of survey of forest soils.

Future Survey Requirements

46.2.13 It is our view that a National Forest Survey organisation should be set up, and its programme should encompass the following elements :

- (i) resource analysis,
- (ii) current and prospective supply of goods and services,
- (iii) current and prospective demand for goods and services,
- (iv) technical support services (data processing and biometry), and
- (v) methodological development.

46.2.14 Both the existing resource and the future possibilities on the same site would have to be assessed. The existing resource should be analysed with respect to the availability of each category of product for each kind of end use. The creation of new resources would include the possibilities of man-made forestry programmes to match the production goals that might be set after supply and demand studies.

46.2.15 In Chapter 41 on Forest Policy, we have recommended (paragraph 41.7.11) that the management of forests should be such that it can effectively contribute towards services rendered by them. Some of the important services rendered by the forests are recreation, moderation of flow of water in the catchment, maintenance of ecological balance, protection of soil against erosion, development of wildlife, etc. Survey methodology for assessing the demand and supply of such services has not yet been developed in this country to an extent useful for practical application. In that chapter, we have also recommended that the land under forestry should be sufficient to meet the current and future demands for these services, which are projected as intangible benefits flowing from forests. While the inventory organisation that we have suggested later in Section 6 of this chapter would work towards development of methodology to assess the demand and supply of these services, the requirements in these respects would have to be built into the forest development programmes on *ad hoc* considerations. In some developed countries

methodology for assessing demand and supply of these services has been developed. For instance, in the USA, resource inventory and the supply outlook for recreation in forest areas have been taken up on well defined procedures¹. A National Forest Recreation Survey was launched in 1959 to define the existing and prospective outdoor recreation situations in the national forest system. The recreation resource inventory was expressed in terms of 'acres of opportunity'. All areas in the National Forest System were evaluated to determine the extent of opportunities for different types of recreation. Localised estimates of future demand, converted into areas of resource needed, were utilised to set specific acreage goals for the inventory of potential 'occupancy sites'. The limits set by these goals provided priorities for identifying, studying and classifying development sites needed in the foreseeable future. It was of course realised that "an inventory of recreation resources is far more complex than counting trees, fish, acres, miles of streams, big game, or other physical characteristics. Recreation resources — that is, present or potential recreation opportunities — are more typically combinations of all of the physical and nonphysical elements of the environments in a specific area or situation. Many of these elements defy measurement and resist even broad classifications; and the variety of combinations is infinite". We are aware that forestry situation in India is vastly different and hence a methodology suited to Indian conditions would have to be evolved.

46.2.16 The methodology for production survey, particularly in respect of wood and wood products, has seen a marked improvement in efficiency of survey designs, techniques and data handling. Many inventories are now being designed on a continuing basis. The first problem is to establish a starting point so that changes can be measured. In this connection, establishment of some kind of permanent plot system that can be measured in part or in entirety over different periods is desirable. As far as specific sampling procedure goes, the success of multistage systematic sampling scheme not only in India but elsewhere in the world as well indicates that a systematic sample should be used for forest inventory. Similarly continued use of a clustered ground sample also seems appropriate.

46.2.17 Since pre-investment inventory field work has been undertaken in most of the major forest conditions, there is a fairly good background for deciding what should be the specific nature of the cluster. However, if the inventory is extended to quantifying timber (trees) on non-forests (cropland, villages etc.), then further work will be needed to ascertain the appropriate type of ground sample. Most

¹ 1965. (September) Outdoor Recreation in the National Forests. Agriculture Information Bulletin No. 301. Washington, D. C. US Department of Agriculture, Forest Service

likely each unit, whether an individual location or an element in a cluster, should cover a relatively large area, say one sq km. This would ensure that the variability of tree occurrence in such areas is accounted for or, for example in the case of trees in villages etc., that at least one village would occur in each sample.

46.2.18 Other works normally involved in production surveys usually include the following items :

- (i) cost studies;
- (ii) wood removal, by product and species (and related value);
- (iii) logging efficiency studies (logging residue studies);
- (iv) special studies such as volume table construction and cull studies etc;
- (v) supply projection studies; and
- (vi) localised studies of established industry and wood use patterns.

Even though reports might, and should, be prepared covering any of the specific activities, these should be usually consolidated or put in proper perspective in an overall analysis of timber supply situation.

46.2.19 Consideration should be given in the internal planning stages to ensure that adequate information becomes available in the future regarding reliable data on growth, mortality, cull, increment and removal rates. Another factor that has to be considered in timber projection work involves the pricing of future timber supplies.

46.2.20 Attempts to measure timber demand normally fall into two categories. The first involves the study of industrial output. The second type of study is usually referred to as a timber requirement study. For example, in one such study the amount of wood by kind and product used in construction of single family housing might be estimated. Over a period changes or trends in wood use as well as absolute amounts can be determined. This information can then be used along with census data on population projections, number of households and related building statistics to make estimates of how much wood has been used or will be needed for meeting housing requirements. However, as in the case of timber supply, future demand has to take into account estimates of future price. For example, if it is assumed that for future demand the price will remain constant relative to competing materials, the demand projections may be relatively simple. Yet, the timber supply may not sustain the projected demand without price increase. Hence an iteration between supply and demand at various price levels is usually required. The result of this exercise should provide information on the extent to

which timber demand could be met with prospective timber supply and the price at which it would be possible.

46.2.21 The demand in respect of fuel or miscellaneous wood products which do not enter into normal channels of commerce is usually difficult to assess. This type of study uses other sources of data like population census, agricultural output or end use surveys. The work in this regard has to be designed in respect of specific produce and situations.

46.2.22 Success of timber demand and supply studies is determined to a large extent by the ability to efficiently accumulate reliable data and to readily retrieve a particular kind of data when needed. Once the kinds of information required are determined, procedures can be designed to provide them. Sampling schemes chosen must be statistically sound and this generally requires special training in statistics. As far as data processing is concerned the only practical means of handling large masses of information is through the use of the electronic computer. The data processing system developed would in turn depend on design, data collection and analysis systems.

46.2.23 The activities of integrated forest inventory are not only to be confined to collection of data but have to be extended to plan strategies and methodology and to evaluate results. A "National Forest Information System" has to be developed which can act as a data bank in respect of all information required for planning, implementation, evaluation and modification of strategies, as and when required.

46.2.24 For organising such an information system the first requirement is to collect all basic information available from various sources in a comparable form in order to have a primary overall picture. The existing sources of information in respect of forest data are :

- (i) working plans;
- (ii) data compiled by the State Forest Departments;
- (iii) State resources surveys;
- (iv) pre-investment survey of forest resources;
- (v) data collected by the Forest Research Institute and its regional centres;
- (vi) land records and agricultural statistics;
- (vii) results of various sample surveys, e.g. National Sample Survey;
- (viii) various socio-economic and feasibility studies in respect of forestry and forest industries; and
- (ix) population census.

46.2.25 Experience in the PIS has shown that while central planning, compilation and tabulation of the results by a Central Electronic Data Processing (EDP) system is suitable and efficient, the collection of field data by Central teams is not efficient because of the long distances and organisational difficulties. We are of the view that the collection of field data at the State or district levels can be more efficiently organised through State resources survey organisation. The State resources survey should be so modified and expanded as to meet the requirement of data collection in the field for the national forest information system.

46.2.26 It is necessary to identify and spell out the functions and requirements for an ultimate use before an attempt could be made to draw up an organisation for building up the national information system on forest resources. Data would be required at three levels to meet the planning strategy, viz. (a) national level, (b) State and regional level, and (c) district or project level. The coverage, accuracy and break up of the data for the three levels would be different. At the same time there has to be a common layout and format so that data could readily flow from one level to another and could be co-ordinated and integrated.

46.2.27 The present data situation in the country reveals that there are fairly good data at the district (division) or project levels for the more developed forestry tracts and reserved forests in some of the States, whereas the same is lacking in the undeveloped forests in certain States. The district or project level data have usually no uniform pattern. This makes State or regional level compilation difficult. State level data are also badly lacking in some of the States which in turn makes national level data unrealistic. One of the first functions of the proposed organisation would therefore be to work out methods for building up the national information system from the existing heterogeneous State or district level data and then plan for collecting additional information.

46.2.28 The national forest information system can be built up in stages as it will not be possible to bring all the district level or State level information on a uniform pattern to make the cumulative national data. The work has to be organised in three district stages, viz. :

- (i) a primary stage where only existing information should be rationalised, standardised and compiled for the country from the available district and State statistics. This phase may take 2-3 years but it will give a fairly reasonable picture for the whole country and will identify gaps in the

information system and fix the levels or reliabilities of the information in various districts and States;

- (ii) the second stage should be the filling up of the major gaps to bring the entire information system at a minimum uniform level. This stage may also take 2 to 3 years; and
- (iii) the final stage should be verification of the entire information by regular survey work at various levels, and continuing and updating the available information.

46.2.29 To build up an efficient national forest information system, the requirements are :

- (i) National Forest Inventory;
- (ii) National Timber Trend Studies; and
- (iii) Data Processing.

46.2.30 National and regional inventories do not differ much in their scope and have the same elements of information and intensity of operations. The national inventory would provide :

- (i) the inventory tables describing various characteristics of forest areas and growing stock at national level;
- (ii) the break-down of the resources by major industrial catchments in the region and States;
- (iii) the forest maps giving location of forest areas and their distribution into stocking classes; and
- (iv) the basic data for regional planning in forest industries.

A periodical check and re-inventory work are essential to keep the information up-to-date and thus carrying out a periodic re-inventory would form a permanent activity of the organisation in the years to come. If no such periodic revision or re-inventory work is carried out in specific areas, the initial survey would be lost and future trends towards increasing or decreasing resources would not be known. The national inventory would help policy makers and planners in taking correct decisions, in the formulation of realistic production goals, in the preparation of developmental plans, industrial management plans and working plans and in evaluation.

46.2.31 Through national timber trend studies it would be possible to have a total picture of supply and demand, which would help in formulating the production goals and preparation of realistic development plans to meet the nation's timber requirements. So far no systematic study of the nation's timber trend has been done. There have been some studies conducted by different agencies, mainly to meet their immediate objectives. It is necessary that studies are

undertaken by one agency so that collection and updating of data are possible and they meet the specific objectives of getting an overall view of the demand situation. The national timber trend studies would provide :

- (i) the information about the pattern of consumption of wood and wood products in the past and present in quality, quantity and value;
- (ii) estimates of likely pattern of consumption (demand) of wood and wood products in future in quality, quantity and value; and
- (iii) the overall foreign exchange position of the commodities movement into/from international trade.

The methodology to be followed would consist of the following steps :

- (i) collection of basic statistical information by—
 - (a) study of existing records, and
 - (b) conducting special surveys;
- (ii) critical analysis of the data; and
- (iii) forecasting future demand, which would take into consideration such demand shifting factors as population increase, rise in income, growth of literacy, pattern of domestic energy consumption, etc.

46.2.32 Automatic data processing through use of computers has been started by the following organisations in forestry :

- (i) Pre-Investment Survey of Forest Resources,
- (ii) Forest Research Institute, Dehra Dun,
- (iii) Andhra Pradesh Forest Department,
- (iv) Jammu & Kashmir Forest Department, and
- (v) Uttar Pradesh Forest Department.

Computerisation is necessary for the preparation of volume and yield tables and processing of linear tree increment plot data. It would also be necessary for the purposes of—

- (i) working plan data;
- (ii) processing of data for national forest inventory and national timber trend studies; and
- (iii) assisting the States in processing their data of working plans, State resources survey scheme, local volume tables, etc.

The main activity of the data processing unit would consist of checking and coding of the forms obtained from the field studies, punching, verification, sorting, tabulating, programming, processing and finally presenting the results in understandable form.

3 FORESTRY STATISTICS

46.3.1 Some aspects of forestry statistics would be covered under the forest inventory, which we have outlined in the previous section. Many more statistics have to be collected by the agencies entrusted with the responsibility of forest management, compilation of working plans, project planning, etc. Detailed scientific investigations would be needed in order that forest management synchronises and harmonises with stand environment. This entails studies in site capability, rate of growth, trends of stand development, outturn data, etc. based on current sampling techniques, designing of experiments for forest research and statistical compilation of data. The economic survey to evaluate the contribution of forestry sector to local and industrial needs is very essential. The value of indirect benefits accruing from forest conservancy and management needs to be quantified and brought out clearly in support of demands for investment in forestry. These and other multifaced requirements of forestry statistics require that collection, analysis and meaningful interpretation of statistics should cover the whole gamut ranging from various services rendered by the forests to the myriad demands made on them by the nation and its general economy. In this section we are dealing with the statistical methodology and relevant issues involved and making recommendations for different steps to be taken, in addition to what we have outlined in the previous Section on Forest Inventory.

46.3.2 The forestry statistics fall under two categories :

- (i) statistics of forest resources — the statistics of forest resource proper are area, production and other concomitant characters of this resource; and
- (ii) scientific data for management of forest resource — these data are required for research and working plans and include amongst others : (a) evaluation of forest resource, evolving and applying sampling techniques in forest survey and analysis of data emanating therefrom (this aspect has been dealt with in the previous section on forest inventory), (b) preparation of statistical design for conduct of silvicultural experiments and utilisation research and analysis of data stemming from such projects, (c) preparation of scientifically tested outturn and volume tables for different species and site qualities based on statistical analysis, (d) compilation of data on growth, increment and loss, and (e) preparation of yield tables. The statistics collected under the latter few items would also go into the inventory of resources and their analysis.

Current Status of Forestry Statistics

46.3.3 Standardised forms for compilation of forestry statistics have been prescribed by the Directorate of Economics and Statistics (DES), Ministry of Agriculture and Irrigation, Government of India, and are in vogue since 1958-59. A summary of the tables prescribed for the Indian Forest Statistics is given in Appendix 46.1. The lowest unit from which forestry statistics originate is the forest range. The statistics emanating from this level are compiled at the divisional level and transmitted to the State forest headquarters, where they are consolidated for the whole State. The Chief Conservators in turn forward a set of statistics to the DES for compilation and publication of the Indian Forest Statistics, only a few States have statistical cells for compilation of data. In the absence of a uniform and adequate machinery, there is hardly any scope for imparting accuracy and timeliness to the collection and compilation of data, let alone for field checking and analysis. Although the summary tables for the Indian Forest Statistics are available for 1970-71, the detailed Indian Forest Statistics published by the DES relate to the period 1960-61 to 1962-63. This is mostly due to non-receipt of complete information from some of the States. Time lag in the availability of forestry statistics returns renders the planning at the national level difficult.

46.3.4 Timely availability and reliability of the statistics can be improved by rationalising and simplifying the proformae. For instance, it is difficult to compile on an annual basis information on items like growing stock, grazing of animals in forest areas or a distinction between fuelwood and wood for charcoal. The returns should not only show the class of produce as it leaves the forests but also the subsequent product of conversion. Pulpwood requires to be shown separately, and not aggregated with roundwood or any other kind of wood. The concepts of value of timber and fuelwood and the markets need to be elaborated. The forest materials are generally auctioned at the coupes standing. Sometimes, the produce is felled and sold by the Forest Departments at the depots or after sawing at departmental sawmills. Thus there are many ways in which the material is sold and the concept of market and the resulting value may have different meanings to render meaningful calculation of national income a difficult proposition. In the case of minor forest produce, the quantity of the outturn is also required. The forest produce removed by different agencies—by Government, purchasers, free grantees and right-holders—are required to be differentiated into end uses to which they are put.

46.3.5 On the setting up of the Central Forestry Commission* (CFC) in 1965, one of the functions assigned to it was to "collect, standardise and publish statistics relating to forestry." The CFC revised the standard forms in its Third Meeting in 1967, and circulated the suggested revised forms to the States. After receipt of comments from the Chief Conservators of Forests and other experts, the CFC has so far been able to standardise annual statistics forms as reproduced in Appendix 46.2.

46.3.6 The CFC has not yet been able to build up a proper organisation for prompt collection of the statistics and their timely analysis and compilation. There is only one Assistant Director (Statistics) in the CFC, and as a result the progress does not measure up to the expectations. The States also have hardly any organisation worth the name. Many important annual and periodical statistical forms are yet to be finally prepared, for instance damage of forests from fire, employment, etc. Furthermore, there are certain lacunae still in the forms prescribed. For instance, for production statistics pit-props and pulpwood are combined. Again, one form requires an assessment of outturn of all sawn timbers from saw logs, apart from sleepers. Such statistics should truly come under "statistics relating to industries".

Suggested Improvements in Forestry Statistics

46.3.7 A broadbased classification of forestry statistics should be made as follows and the standard forms revised and regrouped accordingly:

- (i) Periodic forestry statistics: statistics such as forest types, growing stock, investment, forest area by composition, forest area by functions, soil types, wildlife distribution, forest area covered by working plans and working schemes, grazing of animals in forests, demands of forest products, etc.
- (ii) Annual forestry statistics : statistics such as forest area not covered by periodic statistics, forest production, end-uses, export-import, revenue and expenditure, damage by fire, regenerated area — natural and artificial, breach of forest rules, employment, etc. and data on plan progress such as plan expenditure, road construction, area brought under social forestry, supply of seedlings for farm forestry, etc.

46.3.8 In some cases, a sample study may also have to be taken up, for instance socio-economic conditions of the people living in the

* See Appendix 42.15 to Chapter 42 on Production and Social Forestry for its constitution and functions.

immediate vicinity of the forest areas. Some of the periodic forestry statistics would be collected as a part of the forest inventory. We suggest that periodical collection of statistics, where prescribed, should be so organised that the data collected prove useful for formulating the five year plans. In some cases, e.g. grazing of cattle in forests, a link with census by other agencies, like livestock census, would be required. All the annual forestry statistics need not be collected through the Chief Conservators of Forests. Statistics with regard to the forest based industries could be collected either by the national inventory organisation or from other concerned departments, like the Directorate General of Technical Development (DGTD), Central Statistical Organisation (CSO), etc. In the following few paragraphs, we are elaborating some of the more important items needing urgent attention under the forestry statistics.

46.3.9 A great deal of discrepancy exists in the statistics on area under forests, as given out in the Indian Agricultural Statistics and the Indian Forest Statistics. We have referred to this position in Section 6, Chapter 41 on Forest Policy. In Appendix 46.3, we have indicated the position with respect to some of the States, where the discrepancy is rather high.

46.3.10 There are many reasons for the discrepancy. It is necessary that at the State level, the Chief Conservator of Forests and the crop reporting authority should get together and take steps to eliminate the differences. Clearcut procedures should be laid down for updating of the records every year and publication of one set of figures by both the agencies. In particular, the States having larger discrepancies should take up such studies first.

46.3.11 Production statistics need to be improved in quality, and their scope should be enlarged. Separate statistics should be obtained of removal of roundwood in solid volume excluding bark, production of processed wood and panel products and pulp and pulp products. The existing annual forestry statistics forms should be revised suitably. The details of the items on which information should be sought should be worked out. For instance, while saw logs, veneer logs and logs for sleepers could be combined, separate statistics should also be collected for veneer logs. Pulpwood should be a separate class under industrial wood. As an adequate forest statistical organisation is built up and intensive management is introduced, it may be necessary to further sub-divide the pulpwood production into that used in the production of paper and rayon grade pulp and that used in fibreboard and particleboard industries. For wood pulp, the data on production by different processes like mechanical, chemical, dissolving, etc. should be collected, together with the total production of different categories of paper and paperboard. For forest development planning, some addi-

tional field data would have to be collected and reported under the production statistics. Major forest produce should be reported species-wise, at least for important species. The mean annual increment for some of the important species, including fast growing species raised in plantations, should be collected. Simultaneously it would be necessary to collect figures for regeneration, whether natural or man-made, of a few important species in the area statistics. The statistics of removal of produce by the contractors lack reliability. Sample checks should be initiated on the recording of these data. The concept of value of output, whether of major or minor forest produce, needs to be defined. The point at which value is to be reckoned should be clearly defined by the Forest Departments in consultation with State Statistical Bureaus. While the primary source (forest administration) would indicate the produce as they leave the forests, collection of production statistics for processed goods should be organised differently, including sampling by the forest inventory organisations. Some information would also be available from the Annual Survey of Industries (ASI) undertaken by the Central Statistical Organisation. The ASI however covers forest industries in what are called 'census' and 'sample' sectors*.

46.3.12 For consumption, statistics, movement of forest produce from one State to another should be accurately reported. For this purpose, sample studies should be undertaken in each sector of the industry, such as pulp and paper, panel products, safety matches, sawmilling, construction, mining, power transmission, etc.

46.3.13 Price statistics of forest produce need to be improved in quality and scope. The office of the Economic Adviser, Ministry of Industry and Civil Supplies publishes index numbers of wholesale prices of different commodities. In this list, forest products as a separate entity are not recognised. Since the degree of movement of prices of timber and fuelwood does not necessarily fall in line with the general trend of prices of other commodities, it is necessary to calculate wholesale price index in respect of timber and fuelwood. To enable such an index to be calculated, a few assembling centres well distributed over the country should be identified in respect of which precise wholesale price statistics should be collected and analysed.

46.3.14 Along with prices, there is need for adequate data on various costs connected with forest management. The data on cost of felling, dragging and transport of wood should be collected. The data on collection charges of minor forest produce are also essential. In this

* Census sector — factories employing 50 or more workers with the aid of power or 100 or more workers without the aid of power, being completely enumerated.

Sample sector — factories employing 10 to 49 workers with the aid of power or 20 to 99 workers without the aid of power, being covered on the basis of probability sample.

connection, we may refer to the methodology of cost studies in European forestry¹. In the disposition of survey materials, the following information was collected:

- (i) General information covering forestry and forest industries:
 - (a) the contribution of forestry to the Gross National Product, (b) the total forest-product balances and external trade with forest products, (c) the structure of the forest-products market and movements in prices, (d) the structure of the labour market and movement in wages, and (e) the main features of roundwood production and processing.
- (ii) Income (revenue) and expenditure (costs) in individual forest enterprises based on actual accounting records: (a) general description of forest enterprises, (b) annual cut (timber output) and income (gross revenue or sales value at place of delivery), (c) logging and transport costs (harvesting), (d) net conversion surplus for stumpage value (price of standing timber sales), (e) cost of overhead, maintenance and improvement (managing costs), and (f) operating surplus.
- (iii) Revenue and costs based on hypothetical forestry models: (a) description of assumed conditions, (b) gross revenue (sales value at delivery places at roadside and at mill), (c) harvesting costs (logging and transport), (d) net conversion surplus, (e) managing costs (overheads, maintenance and improvement), and (f) operating surplus.

It may be worthwhile to quote also the classification of costs adopted:

"The dividing line between primary and biological forest production (timber growing) and the secondary or technical phase of production (harvesting or logging) should in principle be considered when apportioning costs according to function. This demarcation is of particular importance since in a number of countries timber is for the most part sold standing. Any division between harvesting and timber growing must necessarily be arbitrary, as part of the costs refers to both phases of production, e.g. administrative costs, costs for roads and buildings, overhead charges, etc. Division into the following types of costs would be expedient: (a) logging and transport (variable costs), (b) maintenance and improvement (common costs). The latter include: (a) silvicultural costs, (b) administrative costs, (c) maintenance costs, (d) cost of improvement and expansion and (e) taxes. It has been agreed that all social charges (overhead) are to be shared among the above cost groups in both phases of production . . . The distribution of social charges can only be decided arbitrarily as many of them

¹ Stridsberg, Einar & Agvere, Karl Victor (Editors), 1967. *Cost Studies in European Forestry*: Chapter 1. Stockholm Royal College of Forestry.

are common cost items; an allocation according to actual labour expenditure would appear to be possible, however. Social charges can suitably be given as a percentage of money wages . . .”

We have quoted the methodology in some detail, as we feel that that this methodology could be adopted with advantage in data collection for cost studies in Indian forestry.

46.3.15 The cost studies would make it possible for a more correct estimation of income from forestry and logging. The forestry and logging industry is defined to include: (a) forestry (planting, replanting and conservation of forests; gathering of uncultivated material; charcoal burning carried out in the forests etc.), and (b) logging (felling and rough cutting of trees; hewing or rough shaping of poles, blocks, etc.; and transportation of logs upto the permanent lines of transport). The improvements that are required to be made for making a better estimation of national income accruing from the forestry sector have been outlined in Chapter 61 on Statistics. For this purpose, it would be necessary to collect production statistics from sources outside the control of Forest Departments, including that from individual agricultural farms. This will also enable a comparison between the apparent consumption and the total production of forest materials, and assist in making a reasonable assessment of the unauthorised removal of forest produce from the Government forest areas, in order that effective steps can be taken for development of forest resource in vulnerable areas and for forest protection.

46.3.16 Regarding employment in forestry, data are unsatisfactory at present. Detailed data of various forest activities in respect of labour employment are necessary and should be collected. The labour employment generated by the forest industries should also be assessed. Forestry works are highly labour intensive. Forestry therefore can play a key role in relieving unemployment and underemployment particularly in the backward tribal areas. Apart from the indication of labour potential of the forestry operations that planned collection of data may give, what is equally important is the study of quantum of available labour in time and place, their alternative occupations, the facilities required to make the requisite labour available, their efficiency, etc. Information should be extracted from the forest records, such as muster rolls, payment vouchers, etc., in which some indication is available at present. The data collected should broadly be of the following nature :

Employment by various forestry operations

- (i) of each category (skilled/semi-skilled and unskilled);
- (ii) seasonal variation;
- (iii) source (local/migrant);
- (iv) status (wholly/marginally dependent etc.); and

- (v) preference in respect of forestry operations, facilities required (food ration, wages, shelter, etc.).

46.3.17 There is a great need for conducting research in statistical techniques as applied to forest surveys and experiments. The statistical machinery available at the State level could also be utilised for this purpose within the broad framework of the country's needs. Fundamental research in forestry statistics should be carried out by the statistical branch of the FRI, in addition to research to be carried out by the data processing and statistical officers of the National Forest Survey Organisation.

46.3.18 Most of the basic information on population statistics and other economic parameters is collected districtwise. The district unit of forest administration is the forest division and most of the forestry statistics are collected divisionwise. It is desirable that the forestry data collection may also be patterned on districtwise basis. For this purpose the data from the forest divisions may be collected in a manner that will enable the data to be split or combined by districts.

4 FORESTRY PLANNING

Planning Strategy

46.4.1 Scientific management of forests in India started more than a century ago with a view to conserve and utilise the forest potential of the country on the twin principles of sustained yield and improvement of site quality. Forest management at that stage was confined to certain specified reserved and protected forests which were managed as Government forests for obtaining maximum returns from them. The management was not aimed at any national production programme in the forestry sector to meet the requirement of the entire population. Forestry production outside the reserved or protected forests, although of a substantial extent, did not find any place in this management. This gap continues to be a big problem in national planning. Production of fuelwood from forestry sources is assessed to be only about 10 per cent of the total fuelwood supply. Although, by and large, items of production like sawnwood or composite wood products and pulp and paper could mainly be derived from the forest sources, an unknown quantity in respect of all these items definitely comes from sources other than reserved or protected forests. Supply of wood from groves or other fruit orchards or from the palm trees and wood production from agricultural lands cannot be ignored.

46.4.2 Forestry production is not confined to forest commodities only. It also includes certain services from the land in the form of protection, recreation or other environmental services. The approach to allocation of land to forestry should be based on considerations of productive, protective and aesthetic functions expected from forests, and has been fully discussed in Section 6 of Chapter 41 on Forest Policy.

46.4.3 National wood requirements in the future years has already been discussed in Chapter 42 on Production and Social Forestry. A strategy for the production of the above goods or commodities in the coming years would be the basic objective of the planning.

46.4.4 Although no studies have yet been made of the environmental services provided by the forests, a substantial increase in this field is also anticipated. The planning strategy should, therefore, aim at providing the necessary forest goods and environmental services to the growing population at the centres of utilisation based on the productive capacity of the available lands both in the forestry and non-forestry sectors. The strategy should therefore not only imply production of wood and services but also their delivery to the users. For the purpose of planning strategy, collection of data and relevant information for planning, implementation of the plans and evaluation, the two approaches, viz. (a) production of goods or commodities, and (b) production of environmental services, may be treated as two separate items.

46.4.5 Unlike other industrial products, one cannot work out the national production or consumption of wood from regulated industries alone. A lot of production goes to utilisation un-noticed. Therefore, for an objective assessment, it is obligatory to categorise forest products by production and consumption patterns. These patterns could be broadly recognised in the following three categories :

- (i) Local Consumption : where wood produced in a particular area is used within a limited distance from the area of production without involving any substantial transport: Such production would include fuelwood for local consumption, small timber and poles for house construction and agricultural purposes and small timber or other minor forest produce for cottage industries, etc., which are used locally without being transported by any recognised means of transport like railways or roads. Such production is not likely to find a place in records anywhere. The only way to assess this requirement could be by sample surveys in different types of areas.

- (ii) **Regional Consumption :** where forest products, whether in the raw form or as processed goods, travel reasonable distance by recognised modes of transport for use in the region itself : Timber requirements mainly for sawmilling or bamboos come under this category where produce is transported by railways or by road or by other conveyance within the region itself. Supply of timber from the forests of Eastern Ghats to the Coastal Plains of Andhra Pradesh is a typical example. Wood production under this category could be fairly well ascertained from transport records or by sampling.
- (iii) **National Consumption or Exports and Imports :** where the produce from any part of the country mostly in the processed form could travel to another part of the country or outside the country for utilisation: Pulp and paper and panel products would form the bulk under this category. This, being mainly of industrial nature, could be accurately assessed from the records of organised industrial units and from export or import data.

46.4.6 Planning for forestry production, whether on a national scale or a regional scale or even purely local scale, will have to recognise the above factors. Planning for fuelwood would be mostly of a local nature whereas that for the industrial wood could be on a national scale. This brings forth the necessity of national, regional or local planning in the forestry sector. Planning could be both from the top at the national level or from the bottom at the local or project level, but for national planning it is essential to have an overall master plan. The national production goals could then be split into regional targets to meet the various requirements both for the regional and the national levels. Finally the regional plans have to be split into many local or project plans which will aim at producing specified products from specified areas. The elaborate planning process will naturally take some time. The actual local or project plans could start independently. The sum total of such projects will, however, seldom fit in with the overall national requirements.

46.4.7 The project plans should hinge around a specific time schedule for specific type of product rather than management of an area. The production oriented plans whether for industry or for local requirement would have different area constituents for different products. For example, instead of aiming at creating fuel production or bamboo production over a certain specific area of so many hectares, what is to be planned is the production of so much of wood or bamboo.

46.4.8 Production of forest raw material for industrial use could lend itself more easily to such a planning, where the objective of a particular management would be to produce specific quantity of a specified material for feeding a specific industry at specific costs. This would then mean that after the management objective has been laid down to produce a certain quantity of wood, the area from where such production would come would be identified. Based on different inputs, the requirement of the area might be kept changing with the development of technology and the amount of inputs that could be afforded. Such a production programme lends itself easily to an economic benefit-cost analysis and investments could be sought for in the conventional financial markets.

46.4.9 At this stage of the availability of information, it may not be possible to formulate any national production plan or even a regional plan very realistically, as the data available on the subject are not very comprehensive or of great reliability. Present studies conducted by the PIS and other organisations involved in the matter have, however, produced certain sectoral analyses in the forestry sector and strategies for forestry development to meet the national requirements.

46.4.10 The situation is far better in respect of area planning or project planning in regions where the PIS has completed its work or where quantitative data are available in the working plans. For such areas in the central zone, southern zone, Jammu & Kashmir and in Andhra Pradesh, sufficient data are now available to formulate projects for specific production of industrial wood as well as for wood production for local and regional requirements. Bastar in Madhya Pradesh is an area where the survey has been completed and an attempt has been made to present a methodology and a model management plan for the production of specific industrial wood. Existing data from working plans can be of substantial assistance for project planning.

46.4.11 While planning or drawing out any management plan of this nature, it is necessary to identify the core industry and its location so that the development of forestry production programme could be planned round such a core industry. No management plan of this nature can be made unless the industrial requirement is established in advance.

Planning and Policy

46.4.12 In Chapter 41 on Forest Policy we have indicated the basis for revision of the national forest policy. The central objectives would be the maximisation of overall benefits from forest resources, existing or to be created, firstly on grounds of environmental

conservation, and secondly to meet the national requirements of forest products and products of forest industries, with a view to achieving self-sufficiency, with a time-bound programme of elimination of imports of forest products and stepping up of export of such products, as well as providing the maximum employment opportunities. Forestry programmes henceforth will also have to be comprehensively formulated on the basis of more detailed surveys and evaluation, thus giving up the *ad hoc* basis perforce adopted in the previous five year plans. An adequate data base for planning has to be built up, besides, it is essential to have proper forestry projects including integrated projects of forestry and forest based industries as a part of the development plans.

46.4.13 Serious under-productivity is the major problem of Indian forestry today. To increase productivity, it is essential to intensify management practices, specially in areas possessing a high development potential and comparatively well developed infrastructure, combined with introduction of quick growing trees or trees more suitable for industrial uses than the existing species. Hitherto even where forestry has moved into comparatively short rotation crops, it has been worked on the principle of minimal inputs, in the expectation of fairly acceptable results. There have been little or no attempts towards optimisation. Unless the inputs are increased, with sufficient built-in margin to take care of such contingencies as abnormal climatic conditions, outbreak of insects and diseases, etc., it is not possible to get the most out of the land devoted to forest crops. Fertilisation, irrigation, use of pesticides, bacterial and mycorrhizal inoculation, combined with the use of superior genetic strains, are the ways for achieving better results. This, however, involves substantially greater investment than at present allocated to forestry. It is to be noted that forestry has already started taking up plantation crops such as rubber, cashewnut, tea, coffee, etc. Simultaneously with the economics of optimal utilisation, essential measures like fire protection are pre-requisite. A much broader research and evaluation base is also necessary than has been hitherto available.

Planning Methodology

46.4.14 The forestry plans should provide for (a) increased production of forest produce to meet the increased national, regional and local demands and (b) increased environmental services, and should include delivery of the produce/services to the consumers at centres of utilisation. The future planning should accordingly provide for the identification of the products and the services. From the product identification and service identification would be derived the national

requirement of wood and other products and services. For translating the requirements into growth goals on which the entire planning strategy will be based, it will be necessary to evolve a "wood and service balance" after a study of the product and service requirements and making necessary adjustments for substitution, diversification of products, import and export.

46.4.15 For achieving the national growth goals, it is necessary to recognise planning processes and methodology at three distinct levels, viz: (a) national plan, (b) regional or State plan, and (c) local plan.

46.4.16 The national plan will in essence be a strategic plan for the overall development of the forestry sector. While it will be the guiding force behind the formulation of the regional and local plan, particularly in respect of end-products, such as pulp and paper, panel products, etc., it will also be the aggregate of the regional and local plans in respect of products and services of regional and local importance, such as sawn timber, poles, fuelwood, etc.

46.4.17 The regional plans, which may for the sake of convenience be termed "State plans", will on the one hand conform to the strategies spelt out in the national plan and on the other they will deal with the problems and cater to the requirements of the region or State concerned. They will necessarily have to go in greater depth into the regional and State problems and aspirations. Their character will be more tactical rather than strategic.

46.4.18 The local plans will be more operational in nature than either the regional (State) plan or the national plan. At the level of the local plans, however, it is necessary to introduce the concept of purpose or production or industry oriented project plans in the place of the area management plans, which are synonymous with forest working plans. The current working plans are essentially area management plans; they deal with the character of a specified area of reserved or protected forests, make an assessment of the crop by types and site qualities (again mainly on an area basis and to some extent on a numerical or volumetric basis) and prescribe the available yield. This approach has made most of our working plans protection or conservation oriented and not production oriented. The sum total of the production possible under the present working plans reflects the national production and the inherent inadequacy of this concept accounts, at least partly, for the low per hectare production. Normally, working plans which cater to the management of the forests within a specified area workout the yield on the production capacity and absorption capacity in and around the area. In areas where there is sufficient demand, the maximum available output may be utilised; but in areas where the demand is restricted or it is

uneconomical to take out the produce to the market, the yields are usually prescribed and limited to the marketability of the produce. The sum total of such yield as national production is, therefore, always lower than the production capacity of the forests in the country. The purpose oriented project plan envisaged in the methodology on the other hand will be based on the concept of production goals — quantities of timber, fuelwood, pulpwood, etc. to be produced and services to be rendered to the community and nation as a whole — and hence will essentially be production oriented. A production oriented working plan will, therefore, derive its pattern not from the immediate neighbourhood but from the planning strategy and goals set forth in the national plan through the regional plans. Block diagrams showing the planning of commodity production and data requirement and flow of the requirements for planning, evaluation and re-appraisal are given in Appendices 46.4 and 46.5 respectively.

46.4.19 At this stage, it is necessary to re-emphasise the significant role of inventories — be they product inventories or service inventories — in plan formulation both at the regional and at the national levels. A correct estimation of the growing stock and of the site characteristics is a *sine qua non* for project formulation, especially in the area of forest industries, and a close link between the plans and the inventories is essential.

5 INDUSTRY ORIENTED MANAGEMENT PLANS

Features of the Plan

46.5.1 We have stated in paragraph 46.4.18 that at the level of local plans, it is necessary to introduce the concept of purpose/production/industry oriented project plans in the place of the current working plans, which are essentially area management plans. It is necessary to give a new dimension to management plans in order that they may truly bring out the productive potential of the forest or of the site on which the forest is to be raised and also bear a purposeful correlation with the goals to be achieved, particularly in the sector of forest based industries. The word 'management plan' (hereinafter in this section referred to as 'plan') in place of a working plan has been introduced to incorporate the broader concept of forest management which includes both area oriented and purpose* oriented plans.

* The word 'purpose' is intended to mean the different objectives towards which the management plan is oriented. Industry, being one of the major objectives in the orientation, has been highlighted in this connection.

46.5.2 A specified forest area, or a specified site over which forest is to be created, produces or is capable of producing a number of forest products such as logs, poles, small timber, fuelwood, pulpwood, bamboo and other minor forest produce. The industry, on the other hand, generally requires only a specific type of raw material. For instance, a *katha* factory requires only the heartwood of the *khair* (*Acacia catechu* Willd.) tree, a plywood factory only ply logs, and so on. An industry oriented plan should be designed for the production of fixed quantities of the raw materials of the prescribed specifications to cater to the requirements of the industry concerned. This calls for a number of adjustments in respect of the area of production and of techniques of production and harvesting.

46.5.3 The raw material requirement of an industry is more or less constant and is required to be sustained over a long period of years generally the life of the industry. Fluctuations in the quantity (and quality) of supplies can be very detrimental to the industry. On the other hand there are certain extraneous factors, such as serious shortage of water, power failure or curtailment, etc., which may call for some adjustments in the quantity of raw materials to be supplied and the management plan will have to provide for absorption in other channels of any material rendered surplus.

46.5.4 The industry also expects the raw material to be supplied at the mill site or at other locations at reasonably constant prices. Abnormal increase in the delivered cost will be detrimental to the industry. In forest operations stumpage is often a low proportion of the delivered cost of the raw material, whereas the cost of harvesting and transport forms bulk of the delivered cost, particularly in the case of low-priced industrial wood, such as pulpwood. Normally for an industry located on a particular site, the most economic procedure would be to obtain its principal raw materials from the nearest distance around the site. Subject to modifications on account of modes of transport (road, railways, waterways, etc.). The location of the catchment in relation to an economic ambit therefore assumes a vital significance in the preparation of an industry oriented management plan.

46.5.5 A particular forest or even a particular tree, produces more than one type of raw material or forest produce. The production of various products from the same area or the same tree should be so balanced as to realise the maximum value from the site and the maximum utilisation of the products therefrom. For instance, if a plan is designed to cater to the requirements of a pulp industry, the bigger logs would have to be utilised in other industries such as sawmilling, plywood, etc. Conversely, while producing the specific

requirements, there might be a number of by-products which have to be profitably utilised in other subsidiary industries. For instance, if a plan is oriented towards supplying the requirements of *khair* heartwood for a *katha* industry, ways and means have to be found for utilising the sapwood chips produced while converting *khair* logs either at the site or in the factory. Similarly a sawmilling, plywood or panel industry might release a large quantity of lops and tops, side planks and logging and processing residues, which it would be possible to utilise in pulp or other industries. A judicious balancing of the utilisation of the various products and by-products, based on benefit-cost calculations, would be an essential feature of the plan.

46.5.6 A mention should be made of the same product being in demand from different sectors. An example is bamboo, which is required by the pulp industry, for general commercial purposes and by the local population for their bonafide domestic requirements and also by village artisans for the making of bamboo-ware such as baskets, mats, etc. The differing economic and social status of such users does not permit a single benefit-cost analysis. The plan has to take a careful note of these factors in order to be realistic and workable.

46.5.7 It is necessary to take into consideration the social needs of the communities living in and around the areas under the plan. The needs are almost always in respect of small timber for constructional purposes and for making of, and repairs to, agricultural implements, fuelwood, collection of fodder and grazing for cattle, collection of minor forest produce, etc. These needs may often be in the nature of rights, privileges or concessions admitted in the area of operation. The satisfaction of these needs will be an important feature of the plan, subject to the principles we have outlined in Chapter 45 on Forest Protection and Law. It might be possible to satisfy these needs from the operational area itself, but it would often be more feasible to set apart separate areas for the satisfaction of these needs. For example, in most of the working plans of Madhya Pradesh, it is usual to set apart separate bamboo felling series, known as *nistar* felling series, for meeting the requirements of the local population in respect of their bonafide domestic needs. In some cases even timber and fuelwood coupes are reserved for the purpose. Even though the arrangement may not be industrially or economically very sound, its neglect might often defeat the purpose of the plan.

46.5.8 Creation of local employment should be specially taken care of in the preparation of management plans, because the entire economy of the tribals who live in and near the forests is mainly dependent on forest operations. This will not only ameliorate the overall standards of living of the people, but also attract active

cooperation of the tribals for forest development activities. Mechanisation and importation of labour in such sensitive areas should receive objective attention.

46.5.9 It needs emphasis that the biological requirements of the species occurring or the species that are proposed to be introduced would be the primary consideration in the formulation of the plan proposals. In other words, the silvicultural requirements of the crop, either natural or man-made, will receive priority over all other factors. The plan will have a definite ecological bias, though the objects of management are re-oriented to serve purposes supplementary to, or other than, those envisaged in the traditional working plan.

46.5.10 In the case of industries, where the requirements of forest raw materials may be in respect of more than one item, or where the same item is of more than one specification, it is necessary to recognise that there may be different area coverages for different types of raw materials. An illustrative case is provided for the newsprint industry, which requires hardwood for mechanical pulping and long-fibered bamboo for chemical pulping. The source of supply of the hardwood need not be the same as that of bamboo. In the case of Nepa Mills, which is at present the only newsprint unit in the country, hardwood for mechanical pulping is drawn from areas close to the factory in the Nimar district of Madhya Pradesh, whereas bamboo for chemical pulping is obtained from far-off areas such as Betul and Balaghat. The ideal management plan for meeting the requirements of such industries will cover not only one forest division or district, but will extend to other forest divisions or districts in the same State, or in some areas in adjoining States. This often calls for close co-ordination between the administrations of different districts or of different States.

46.5.11 Since cost factors seldom remain constant over a long period and price fluctuations materially affect the working of the industry, it is necessary that fiscal calculations should not normally be prepared for a period of more than 8 to 10 years. Projections beyond this period will not only become redundant and out of date, but will also give an unrealistic picture of the economic viability of the project. This does not, however, mean that the area coverage should not be projected beyond a period of 8 to 10 years. There should be adequate areas kept in reserve to meet the requirements of the industry for the entire rotation, felling cycle or conversion period.

46.5.12 An industry oriented plan cannot be left to the mercy of annual budgeting, as this not only affects the immediate supply of raw material to the industry, but also hampers the creation of man-made forests. The project finances have to be provided for the entire

period of the plan. In other words the provision of financial and other inputs, including staff and equipment, should form an integral part of the sanction of the plan by a competent authority, be it Government or a corporation, and this sanction will imply sanction to the financial outlays and other inputs envisaged in the plan. While it is not necessary to project the financial requirements for a period of more than 8 to 10 years, it is desirable to draw up in perspective a plan for the entire rotation or conversion period in terms of 'units' or 'indices' (e.g. volume of pulpwood to be converted, areas to be inventoried or planted up, etc.), in order that future planners may have no difficulty in identifying the targets.

Phases in the Preparation of the Plan

46.5.13 The first phase of the industry oriented management plan would be the optimum utilisation of the existing crop (crop I). For this purpose an accurate quantitative assessment of the existing crop, and of annual 'cut' or production, is a 'must'. Ways and means should be devised to ensure accuracy in the assessment. As already mentioned in paragraph 46.5.7 above, it is necessary to take into consideration the requirements of the local population (or of existing industrial units, for which commitments already exist) while making an assessment of the annual availability for the industry. If the industry is still in the gestation period, methods of utilising the annual cut till the industry goes into full production should be prescribed.

46.5.14 The second crop (crop II) need not be a reproduction of the original crop, but should be planned for the actual requirement of the industry, not only the existing industry, but also the projected and recommended industries. For instance, the existing mixed hardwood may be utilised for pulping (and the surplus quantities otherwise utilised) in the first cycle (or conversion period), but in the second rotation the growing of eucalypts or tropical pines can be incorporated in the plan subject to site suitability. In making projections in respect of the annual cut from crop I, where the raw material produced falls short of the requirement of the industry, it will be necessary to indicate alternative areas from which the short-falls may be obtained under the prescriptions of the current conventional working plans.

46.5.15 While planning the utilisation of crop I and the creation of crop II, it is essential to ensure the continuity of supply of the required quantities of raw material to the industry. The creation of crop II should be so planned that it meets at least the current commitments to the industry, both quantitatively and qualitatively, but

not necessarily of the same species. It will often be safe to reserve some areas as a 'buffer' to tide over the emergency created in cases where the production from crop II may not come up to expectation. Conversely by the selection of faster grown species, or by additional inputs, additional production capacities can be built up, which can be absorbed either by expanding the projected industrial unit or by establishing new industries. A great deal depends upon correct site appraisals, accurate inventories, adequate technological knowhow and optimum inputs. A close liaison between, or purposeful integration of, forestry and forest industrial sectors is necessary.

46.5.16 For the purpose of industry oriented plans, the following two types of areas may be recognised :

- (i) Developed areas where, by and large, most of the produce is already easily marketable, and fairly accurate data on the resources, etc. are available : In these areas the infrastructure is usually well-developed and the fiscal structure is also stable or settled. In such areas the plan will start by optimum utilisation of the existing material and replacing them by faster and better grown species in order to realise the maximum per hectare production. In other words conditions will be quite suitable for switching on straightaway to conversion.
- (ii) Underdeveloped areas where the existing material is not being fully utilised for want of established demand and usually a utilisable surplus is available : There is generally a poor data base. The infrastructure is either poorly or inadequately developed. A thorough inventory in such areas will be an essential pre-requisite for the preparation of industry oriented management plans. Usually these areas are more amenable to diversification of forest production and to the production of additional industrial raw material. These areas deserve intensive attention. Present activity in such areas would be to make the optimum use of crop I material. Appendix 46.6 illustrates an industry oriented management plan for Baster, Madhya Pradesh.

46.5.17 Production techniques should be diversified by heavier inputs and better methods of regeneration—both natural and man-made. An adequate research base for tackling problems arising out of the projects should be inbuilt in the plan itself to meet this fundamental requirement. A system of control and evaluation should also be provided for in the plan.

46.5.18 A normal working plan can be recast to accommodate the requirements of a specified industry in respect of raw materials,

as an interim measure. The idea of accommodating industrial requirements is already inbuilt in many of the working plans, by the formation of overlapping working circles, such as *khair* for *katha* industry, *semul* (*Bombax Ceiba* Linn.) for match industry, *salai* (*Boswellia serrata* Roxb.) for packaging and newsprint, bamboo for pulp industry, etc., but the linkage is not complete. In Madhya Pradesh working plans, it is usual to classify bamboo felling series into *nistar*, commercial and industrial felling series, the last to accommodate the requirements of paper and newsprint industries.

46.5.19 The idea of conventional working plans being recast to accommodate industrial raw material requirements is exemplified by the working plan for the South Nimar Division of Madhya Pradesh. This Division is situated around the newsprint factory at Nepanagar and the delivery of fresh *salai* pulpwood at reasonably low costs is of vital importance to the production and price structure of newsprint. Accordingly the formation of *salai* overlapping working circle in the latest revision of the working plan is oriented to the supply of fresh *salai* pulpwood to the newsprint industry. A plantation working circle has also been formed to raise plantations of eucalyptus to meet the requirements of the Nepa Mills. In the working plans of Nimar, Hoshangabad and Betul Divisions, a specified number of bamboo felling series have been reserved for meeting the requirements of Nepa Mills in respect of long fibred bamboo pulpwood. In an industry oriented management plan visualised by us, the linkage between the industry and forest management will be more fully developed (without undue sacrifice of the local economic and social factors) and the plan will be formulated for the catchment as a whole transcending the divisional or district boundaries. It will be reasonable to expect that the industry itself will make a substantial contribution in the formulation of the plans and in the harvesting and delivery of the raw material.

6 ORGANISATION

Central Organisation

46.6.1 In our Interim Report on Production Forestry Man-made Forests, we have recommended the creation of a Planning Cell headed by an Additional Inspector General of Forests in the Union Ministry of Agriculture & Irrigation. We are of the view that forest inventory and evaluation cannot be separated from forest planning. Hence in the Union Ministry of Agriculture & Irrigation, under the Inspector

General of Forests (IGF), there should be a division of Forest Inventory, Planning and Evaluation under the charge of an Additional IGF.

46.6.2 In the organisational set-up at the Centre, there should be two wings under the Additional IGF, each in charge of a chief co-ordinator in Deputy IGF's rank : (a) national forest survey, as outlined in Section 2 of this chapter, and (b) planning cell as recommended in our Interim Report on Production Forestry—Man-made Forests.

46.6.3 National forest survey organisation should actually be built up by expanding the existing PIS. It should have four regional units* as follows :

- (i) Northern Region—Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Punjab, Haryana, Delhi and Chandigarh;
- (ii) Eastern Region—Bihar, Orissa, West Bengal, Assam, Nagaland, Manipur, Tripura, Meghalaya, Mizoram, Arunachal Pradesh and the Andaman & Nicobar Islands;
- (iii) Southern Region—Kerala, Karnataka, Tamil Nadu and Andhra Pradesh; and
- (iv) Western Region—Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Goa, Daman and Diu and Dadra and Nagar Haveli.

There should be small headquarters unit for coordination and for undertaking the work at the national level. In our opinion it should be mainly the Central Government's responsibility for carrying out continuous inventories and assisting the States in planning. The regional units should also be responsible for building up and maintaining a data base and for taking up evaluation and coordination work in consultation with the respective States/Union Territories. Regional units should therefore be self-sufficient in terms of facilities and data processing. The regional units will feed the necessary data to the headquarters unit so that overall national data are maintained and national plans made.

46.6.4 We recommend that the entire forest area should be surveyed every 10 years, giving an estimated target for annual survey as 6 to 7 million ha. It is estimated that for obtaining reliable data on forest resources in each region, nearly 2,000 field samples would have to be taken each year.

46.6.5 As we have explained earlier, the major techniques employed would be : remote sensing and, in particular, aerial photo-interpretation, use of modern statistical methods and use of electronic computers for data processing. For the various technical disciplines in the Central organisation, there should also be counterpart disci-

* There are at present three zones in the PIS which may be reorganised into the proposed four regions.

plines in the State organisations in some cases. Persons with suitable specialisation and experience will be in charge of the specialised functions to plan, guide and control the output in their respective fields. The functions of some of the specialised disciplines that may be required in the forest survey organisation are explained in the following paragraphs.

46.6.6 Environmental expert would be entrusted with collection of information about the forest types, distribution, growing conditions, ecological changes and other factors affecting the biological growth of the forests and wildlife. It is first necessary to know the limits of biological possibilities before any elaborate attempt is made to collect sophisticated quantitative data in order to avoid wasteful work. As an example, unless a particular technique to manage the crop on a particular silvicultural system is known the data collected may not serve any purpose in the absence of knowledge about the treatment of the crop. Moreover, behaviour, occurrence and proper management of wildlife are as much a resource management as that of any floral product.

46.6.7 Resource analyst is an important technical specialist required for any effective inventory and planning. He will analyse all the available information, work out the data requirement for various purposes, determine the survey intensity and priorities and suggest methods for collection of future data. When the data are collected, he will interpret, analyse and supply them to the users, and suggest more effective data collection methods and designs.

46.6.8 Photo-interpretation experts would be necessary to interpret the large number of aerial photographs which would cover the forest area. It is equally necessary to develop different interpretation techniques including preparation of photo-interpretation keys for use on a production scale.

46.6.9 Statistician would devise efficient sampling methods so as to avoid ineffective and expensive field work. A good statistical analysis is necessary to know the results and plan for more efficient designs for future work.

46.6.10 Industries expert would be responsible for the analysis of the available material for various industrial and other uses. Utilisation of available raw material is the main object of forest planning. A theoretical knowledge of the existence of wood or other material in the forest would be of no use unless it could be classified into categories for different uses and quantified for each category.

46.6.11 Industrial and transport economists would carry out studies for a continuous systematic data regarding conversion, transport and utilisation economics. Forest materials, being scattered over large areas and usually situated at places away from centres of utili-

sation, have to be assessed in relation to the costs involved in delivering the goods to the utilisation centres. A mere existence of a material does not mean a source for economic development unless it can be economically harvested and utilised.

46.6.12 Data processing specialists and qualified and suitable programmers in requisite numbers are necessary to handle the processing work of the survey organisations. The large volume of data collected through questionnaires, reporting sources and collected in the field cannot be effectively and quickly handled except through the use of electronic computers. The data bank should be placed under a Director of Statistics.

State Organisation

46.6.13 The Central responsibility should be the field surveys and inventory, analysis of resource, data processing, maintaining data bank, etc. The States could draw on the requisite information for planning purposes from the Central organisation (actually from the regional units). Such an arrangement to be successful would require working of the national survey organisation at peak efficiency, with all the key personnel in position. We have mentioned in paragraph 46.6.6 : "The elaborate planning process will naturally take some time. The actual local and project plans could start independently". In order to achieve this, it is necessary to create State resources survey and planning organisations each with its own field staff. But a reasonable uniformity in carrying out forest surveys and planning work should be ensured.

46.6.14 We have recommended later in this section the setting up of a regional coordinating body to see that efforts of Central and State organisations are not duplicated. We visualise that ultimately a pattern will emerge in which the States would be responsible for collection of all statistical data sought for by the regional units of the Central Government. The latter would process and analyse the data and maintain the information bank for feeding the States with the necessary data and assisting them in their planning work.

46.6.15 Since the States vary much with regard to their potential forest resources, no uniform organisational set-up applicable for all States can be suggested. Depending on the resources of a particular State, the head of the State organisation could be an officer of the rank of Chief Conservator of Forests (CCF), Additional CCF, Deputy CCF or Conservator of Forests (CF). Similarly, the different disciplines could be suitably grouped. The disciplines that we have in view are : (a) working plans, (b) project formulation, (c) resources survey and inventories, (d) utilisation, (e) timber trends, market

analysis and economics, (f) forest industries and (g) statistics. Since the functions are self-explanatory, we are not elaborating on the State organisational set-up.

Coordination between Centre and States

46.6.16 We recommend that there should be an Advisory Council at the Centre to advise on the policy of forest surveys and priorities to be assigned and to provide necessary coordination with the concerned industries. The IGF should be the Chairman of the Council and members would be drawn from the Directorate General of Technical Development, Planning Commission; all the State Chief Conservators of Forests and representatives from public sector forest based industries. The Additional IGF would be the Member Secretary of the Council. The Advisory Council should normally meet once a year.

46.6.17 As difficulties have been experienced in some cases in utilising the results of the pre-investment survey, and other problems have arisen from time to time, it would be necessary to have regional technical committees, one for each region, to decide the details of technical working, inter-relationships of forest surveys with local plans and connected matters, and suggest priorities for surveys. The chairman of each of the committees would be the Additional IGF* and the members—the heads of State resources survey and planning organisations. The Chief Coordinator, National Forest Survey, should be the Member Secretary of the committee. The committee should also decide on the spheres of work of the Central and State organisations for particular period of time, say one year, settle the difficulties in the flow of data from one organisation to the other, and should be instrumental in gradually planning the work in such a way that the pattern of responsibilities indicated by us in paragraphs 46.6.13 and 46.6.14 above is harmoniously achieved. The technical committee should meet once a year.

46.6.18 We would also like to state that the Centre is in the pivotal position to assess the progress of the development programmes in different States and regions, collect and analyse the relevant data and act as the "staff" for the entire economy. The inter-State or indivisible nature of some of the projects or services and the limited technical, financial, institutional and administrative resources of some States may prevent them from undertaking them in the State sector, particularly in the initial stages. Some examples are forest inventory, data bank, evaluation, intensive forestry development projects in backward and dry areas, etc. For effective forest development planning, the Centre acts as an agency for transfer of improved technology

and techniques from one State to another, and even from other countries. Fields in which such transfer of knowledge is required are the phenomenal technological development in panel products industry, forest productivity, etc.

46.6.19 A few areas where specific action in the matter of Centre-State coordination is required in forest development planning are:

- (i) States should be closely associated with the formulation of the Central and Centrally sponsored sector projects. For this, joint working groups consisting of the Central and State representatives could be set up.
- (ii) The staff requirements of a particular State Government under the plan schemes should be assessed over a period of time including the requirements on account of Centrally sponsored schemes, and the State cadres should be created on that basis.
- (iii) A strategy has to be evolved under which Central or Centrally sponsored schemes which are implemented through State agencies ultimately form part of the State sector.
- (iv) Easy and adequate availability of institutional resources from the national institutions to the State level bodies, without procedural hurdles, is necessary for maintaining the expected rate of development.
- (v) Planning and organisation in respect of availability of institutional finance should be provided by the Centre.

Statistical Organisation

46.6.20 Forestry statistics are collected mainly as bye-product of forest administration and management and would continue to be so. However, with the greater increase in the requirements of statistical data for policy formulation, planning and implementation of forest development programme, the existing agencies at different levels for collection of these data are inadequate and need to be strengthened. In order to enable the collection of the various types of data suggested by us, we are of the view that a wholtime Forester (Statistics) should be provided in each range to attend to maintenance of registers, culling out data from the records and reporting them to higher levels in the prescribed proforma. At the divisional level, the Divisional Forest Officer should be assisted by a Range Forest Officer (Statistics) on a wholtime basis for this work. In addition to consolidation of information at the divisional level, he should also visit the different ranges and verify the accuracy of the various data collected in the ranges. He may be assisted by a Junior Statistical Assistant in compiling and consolidating the returns. At the circle level, the statistical

agency will consist of a Class II Statistical Officer, assisted by requisite complement of statistical assistants and clerks. Their functions will be not only to consolidate the data received from the different divisions, but also to analyse and interpret the data so as to help in the planning and formulation of suitable programmes.

46.6.21 At the State headquarters, the Chief Conservators of Forests should be assisted by a Director of Forest Statistics of the rank of a Conservator of Forests. He should be assisted by requisite number of statisticians to deal with different aspects. Corresponding strengthening is necessary at the level of the Union Ministry of Agriculture & Irrigation also. The existing statistical unit in the Central Forestry Commission should be developed into a fullfledged statistical division and put under the charge of a Statistician in an appropriate scale.

7 FOREST RESEARCH AND EDUCATION

46.7.1 In the forestry sector, research and development could not keep pace with the times and needs due to various constraints—organisational, financial and technical. Considering the urgent necessity for creating a sound research base in the Forest Departments in the States, the universities, Forest Research Institute, Dehra Dun and its regional research centres at Coimbatore and Bangalore and for reorienting forest education, we submitted an Interim Report on Forest Research and Education in March 1974. In that Report we have dealt with the organising of forest research and education with particular reference to direction and promotion, identification of problems and formulation of programmes, adequacy of funding and a new approach to the personnel policy for research and education. While briefly highlighting the recommendations made in our Interim Report, we examine in this section the current problems of forest research and the improvements necessary in the manpower training.

Historical

46.7.2 The beginning of organised forest research was made in 1906 with the establishment of a forest research institute at Dehra Dun. In the late twenties, the FRI moved into acquired lands on the outskirts of Dehra Dun, and the new location was named 'New Forest'. This facilitated some expansion of research activities and taking up of experimental plantations within New Forest. The work done in the FRI led, amongst others, to the compilation of yield tables for important forest species, the preparation of a treatise on

silviculture of Indian trees and on forest insects and pests, the publication of a statistical code and an experimental manual for standardisation of the statistical and experimental work, research on the anatomy of Indian timbers, natural durability and refractoriness of a large number of species, utilisation of forest products and more particularly use of bamboo as a pulping material.

46.7.3 The provinces (now States) concentrated on silvicultural research mainly in connection with regeneration work. Silviculturists were appointed in the United Provinces in 1918, Bengal and Madras in 1919, Bihar and Orissa in 1921, Central Provinces in 1922, Assam in 1927, Bombay in 1929 and Punjab in 1930. Since then all the States have created posts of silviculturists—in some States more than one. Maharashtra, Uttar Pradesh and Madhya Pradesh now have research laboratories. West Bengal has established a soil laboratory under one of the silviculturists. Silvicultural conferences used to be held quinquennially to discuss problems and techniques of forest research. This paved the way for cooperative research on important common problems concerning several provinces (States), such as regeneration of *sal* (*Shorea robusta* Gaertn.f.), management of bamboo, importance of seed origin in the case of teak (*Tectona grandis* Linn. f.) plantations, etc.

46.7.4 In 1972, the Court of the FRI decided to replace silvicultural conferences by two Conferences to be held at five years' interval, one on forestry* and forest biology and the other on forest products. The purpose of each Conference is to indicate the areas in which research should be initiated and intensified. Panels have to be set up for each particular field of research to revise the current programmes for each branch of the FRI and to recommend programmes and projects for consideration by the research councils of the FRI. The first such Conferences were held in 1974.

46.7.5 The FRI is the only institute in India for forest research, with two regional research centres at Coimbatore and Bangalore under it. While the FRI carries out research on practically all aspects of forestry, forest biology and forest products, the Coimbatore centre is concerned with regional problems in entomology, mycology, silviculture and soil science, and the Bangalore centre with those in sandal spike, wood preservation, wood anatomy and chemistry of minor forest products. The FRI has got colleges under it for in-service† training of officers in the Indian Forest Service, State Forest Services and Forest Rangers. The Indian Forest College (IFC) and the

* The term 'forestry' in this section is used in a restricted sense to cover: (a) silviculture, (b) silvics, including physiology and forest influences, (c) ecology, including wildlife, (d) forest soils, (e) forest genetics and tree breeding, and (f) social forestry.

† includes pre-service education and training also.

Northern Forest Rangers' College (NFRC) are located at Dehra Dun, the Southern Forest Rangers' College (SFRC) at Coimbatore and the Eastern Forest Rangers' College (EFRC) at Kurseong (West Bengal). The full name of the composite institution is Forest Research Institute & Colleges abbreviated for convenience as FRI. It has attained worldwide recognition as the premier institution for forest research and education in the tropics.

46.7.6 Most of the States are engaged in field-oriented research, especially in silviculture, but are not at all equipped to deal with the problems and prospects of research in the field of forest products. Unlike agriculture, research in forest science is hardly carried out in the universities in this country, and barring some ecological research at a few centres, no university is conducting any research bearing on forestry. There has been no fruitful cooperation established between State Forest Departments and the agricultural universities. Comprehensive facilities for research in some of the disciplines, including forest management, economics, ecology, etc. are yet to be built up.

46.7.7 Due to the State ownership of most of the forests, forest education and training has perforce been confined to the limited personnel of the Forest Departments. The IFC undertakes the education and training of the officers in the higher Services, viz., the Indian Forest Service and the State Forest Services. The education at this level is the only professional one in forestry available in India at present. The education and training of the Forest Rangers, at sub-professional level at present, is conducted in the Forest Rangers' Colleges. The training and education courses run by the FRI have been approved by the Food & Agriculture Organisation of the United Nations (FAO), which has recognised it as a training centre for South East Asia. The States are responsible for imparting training in their forest schools to the Deputy Rangers/Foresters, and in a few States, there are also schools for training of Forest Guards. They mostly get on-the-job training to enable them to carry on their functions satisfactorily. But in all the States the capacity of these schools is far below the demand of trained staff. Most of the States have not been able to create facilities for the training of the Forest Guards. We are of the view that there are two vital lacunae in the field of forest education : (a) a close institutional link between research workers and teachers does not exist, and (b) the universities are not yet involved in forest education.

The Interim Report—A Short Summary

46.7.8 We were of the view that immediate attention was needed to give a new orientation in forest research and education. We spelt

out our recommendations in the Interim Report on Forest Research and Education. We recommended that forest research should be re-grouped into: (a) forestry and biological research, (b) industrial and utilisation research, and (c) forest management and operations research including statistics, economics and marketing research. A particular responsibility of the Central Government would be to carry out industrial research which requires a large capital investment and special expertise and equipment. The Central Government alongwith universities should also coordinate and collaborate with researches on utilisation, harvesting, economics, marketing etc. in the States. Apart from the FRI, which would continue as a 'national institute' the Central Government should set up, where necessary, multi-disciplinary regional research institutes and specific problem-oriented research centres.

46.7.9 So far as the State Forest Departments are concerned they are to confine themselves primarily to applied research on local problems in the field of forestry, forest biology and forest management. They may, if necessary, establish properly equipped and staffed research institutes for the purpose, keeping in view of the size of the State forests, the complexities of their problems and the prospects of their development. State forest research institutes/organisations are to work in close collaboration with the universities, in addition to continuing the collaboration with the Central forest research organisations.

46.7.10 We opined that forest research would be enriched if the facilities and expertise available in the agricultural universities are fully utilised to support the research needs in the States. Other universities can also undertake complementary research in collaborating with the Central and State organisations in such fields as botany, zoology, pathology, hydrology, economics, etc. The State Forest Departments should provide the necessary facilities and support. The universities could involve themselves in applied research also as a joint programme with the Central and State forest research organisations.

46.7.11 Regarding forest education we recommended the gradual approach to the introduction of teaching in forest science in the agricultural and other universities, which are to undertake forest research. They should, to begin with, include forestry as one of the subjects in the undergraduate course, the scope of forest education being gradually widened to graduate, master's and doctorate degree courses in forestry, as qualified staff and other facilities needed for research and teaching become available. The syllabus of forest education should be drawn up by a national committee, specially appointed for the purpose.

46.7.12 The FRI should also organise graduate, master's and doctorate degree courses in forest science outside the in-service training and education courses. We had stated that the courses for the in-service training and education for the higher Services should be adjusted to make them equivalent to the corresponding degree courses in the universities.

46.7.13 Whether in the universities or at the FRI, the elements of teaching and research should be integrated. Thus the research worker would be drawn into the forest education, and reciprocally the teachers could also be actively involved in research work. For this purpose a basic reform in the FRI would be necessary, as outlined in the Interim Report. Teachers therein should be specialists in their respective subjects. So far as the in-service training and education of the Forest Rangers are concerned, we had stated that similar integration of research and education should be attempted in the concerned research-cum-teaching institutes.

46.7.14 We also recommended that the aptitude for research and teaching must be fostered and developed. Accordingly, several aspects, as indicated in the Interim Report, should be taken into consideration in the management of personnel for research and education. We had also indicated the procedure to be adopted for promotion of the personnel from grade to grade to attract, develop and foster the specialised knowledge.

46.7.15 In view of the major responsibility of forest research and education devolving on the Central Government it will be necessary to create a Central coordinating agency. Full autonomy for such an agency for forest research and education may not yet be feasible. A stage of autonomy in undertaking, aiding, promoting and coordinating agricultural education and research and its application in practice has evolved through years of experience. Likewise, we suggested that forest research and education could also be given suitable autonomy in course of time.

46.7.16 The agency we had recommended for direction and promotion of forest research and education is a Council of Forest Research and Education (CFRE) to be set up in the Union Ministry of Agriculture & Irrigation. The CFRE should have the Central Minister of Agriculture as the Chairman, and, apart from forest officers, there should be others, like the Director General of Indian Council of Agricultural Research (ICAR), the Director General of Council of Scientific and Industrial Research (CSIR), research scientists/teachers from universities/forest research organisations and also from outside the forestry discipline as members. The various disciplines of forest research and education should be grouped into the following three wings of the CFRE, each to be assisted by a

Standing Committee: (a) forestry, forest biology, forest management and operations researches, (b) industrial and utilisation researches, and (c) education and training.

46.7.17 We had expressed our view that research would drift away from the desired direction, unless forums are built up for identification of the problems and formulation of the programmes. We have indicated the responsibility of the CFRE in this respect in the Interim Report. For identification of research problems, two technical committees would be required to be set up by the CFRE for each region* for the forestry and industrial research wings. These committees would pass on the problems after assessing priorities to the FRI, regional and State institutes/centres for formulation of research programmes by technical panels, one each for a discipline or a group of allied disciplines. The universities undertaking forest research would also have to be associated in the identification of research problems. On the basis of the research programmes formulated by the panels, regional conferences should be convened for a thorough discussion. The FRI and the regional research institutes, the States, the concerned universities and the forest based industries in the region should be invited to participate in the regional conferences. Only competent personnel well versed and involved in forest research should represent their organisations at the regional conferences. The recommendations of the conferences should be available to the Inspector General of Forest before the approach to the next plan is drafted for approval by the CFRE.

Research Needs of Forestry and Forest Biology

46.7.18 As mentioned above, the responsibility for indentifying research problems should be delegated to the regional technical committees. However, after a study of the various aspects of forest research work that is being carried out in the country and in the light of developmental problems that await solution and the gaps in knowledge that exist, we consider it necessary that some broad outlines of the topics of research which appear important should be recorded. The technical committees should consider, and give due importance to, these broad outlines while identifying the research problems.

46.7.19 The main objectives of research in forestry and forest biology would be to discover ways to improve production from all types of forest land as far as possible and to extract the maximum amount of produce from both natural and man-made forests. It

* The regions are eastern, northern, western and southern, vide paragraph 3.20 of the Interim Report on Forest Research and Education, March 1974.

would be necessary to intensify research on the introduction of fast growing species, both indigenous and exotic. Studies on the mineral requirement and fertiliser requirement of forest species would remain an important area of research, particularly in the matter of raising better nursery stock. The production of quality seeds and their storage should also receive attention. There is need for an identification of the studies required on forest influence, particularly with regard to the water requirement and its consumptive use, micro-climate of forests in both natural and artificial regeneration areas, etc. Although afforestation works have been taken up as a programme of soil conservation in upper catchments of many river valley projects, no systematic experimentation has yet been done on the effect of such practices on the water quality and quantity. This might be made good.

46.7.20 In the field of ecology, the FRI has done some synecological studies on teak and *sal*. Autecological studies have also been undertaken on *sal*, teak, fir, spruce, *chir* (*pinus roxburghii* Sargent), *kail* (*P. wallichiana* A. B. Jackson), bamboo, etc., in particular on their nutritional aspects. These studies, which are continuing, have given positive indications as to the growth requirements (nutrient requirements and uptake, moisture requirements, soil suitability index, root competition and development, competitive potential, drought resistance, mortality, etc.) of different afforestation species, whereby suitable species can be selected for different sites. It would be necessary for the CFRE to arrange a large scale coordinated research programme on the ecology of a few species which would have particular relevance to production and social forestry.

46.7.21 Wildlife research in this country is not so well-organised. Conflicting viewpoints are already being voiced regarding the suitability of large scale adoption of a production forestry programme *vis-a-vis* wildlife habitat. The effect of man-made forests on wildlife management should be one of the most important topics for future research. However, research in wildlife management need not necessarily be the responsibility of any one institution. Suitable forestry personnel or outside specialists could be entrusted with specific research projects. The CFRE should be able to identify suitable projects, personnel and sites for research in wildlife management, including setting up of a research cell in the FRI, as recommended in Chapter 44 on Forest Ecology and Wildlife Management.

46.7.22 Forestry research would not be complete without a complementary research on forest soils. Studies on forest-soil-vegetation survey, improvement of problem soils in various areas, soil-water-plant relationship and effect of interaction of different applications and practices on forest soil would remain important areas of research in

different classes of soil. A special forest soil problem would be that of latosols and lateritic soils *vis-a-vis* forest management practices. These soils are found over a large part of India, particularly in southern, south-western, eastern and north-eastern parts. As long as forest management was conservation oriented, perhaps the soils were not adversely affected. In view of our recommendation of intensive man-made forestry programme, we visualise substantial increase in man-made forestry activities and use of fertilisers in areas containing latosols, and as such the possibility of an undesirable effect of the programmes on soil has to be considered as also the soil management for retaining and increasing productivity. The existing research on latosols for agricultural purposes would not serve the requirement of forestry. In the growth of trees, the deeper layers of the soils are concerned. Moreover, under forestry there are no annual tillage or crops. The soil test devised for agricultural soils would not be suitable for forestry purposes. There is thus a need for a comprehensive programme of research on latosols *vis-a-vis* forests management practices. Unless such a programme is made out there is every likelihood of a large area of latosols becoming less and less productive, bringing in its wake other problems including its effect on water regime. In our Interim Report on Forest Research and Education, we have recommended establishment of problem-oriented research centres and we are of the view that research on latosols qualifies for such an approach.

46.7.23 It would be necessary to undertake selection of *plus* trees of species important from the point of view of production and social forestry, and the State forest research organisations would have to establish seed orchards and clone multiplication plots near the proposed areas for seed orchards, after collection of scion material from the *plus* trees. Some work in this regard has been done in the FRI. The CFRE should arrange for evaluation of the experimental results and ensure their adoption by the States. Controlled hybridisation in the case of important tree species like teak, Eucalyptus, pines, etc. would have to be intensively studied in order that tree breeding for important species is successfully carried out.

46.7.24 In the case of research on different aspects of social forestry, we have given a few illustrations in our Interim Report on Social Forestry. While some of the researches outlined above would definitely be of use in the implementation of social forestry programmes, one of the most important directions which social forestry research should take is with regard to finding out suitability of species for wind-breaks and shelter-belts, plantation techniques in degraded forests and wastelands, effect of different species in shelter-belts and

wind-breaks on crop yields and economics of various activities proposed to be undertaken under the programme of social forestry.

46.7.25 Another important aspect of research with regard to social forestry is finding suitable undercrops and grasses for raising in the fuel plantations. The results of such research would be equally important for realising the full potential of forest soils in the case of production forestry. We have indicated the importance of grass in the rural economy. We recommend that the State forest research organisations and the universities taking up forest research should between them take up this important research activity in a coordinated manner.

46.7.26 In the field of biological research, it is recognised that monoculture generally leaves a higher incidence of pests and diseases. The recent experience in eucalypt plantations in Uttar Pradesh, Kerala and Karnataka shows that pest and disease hazards in such plantations are high and in extreme cases may threaten the success of the plantations. Hence a survey of pests and diseases and their control should be a priority research scheme in biological research.

46.7.27 The control of spike disease of sandal (*Santalum album* Linn.) has eluded the research workers so far. Spike disease of sandal is a "yellows type of disease" showing witches broom effect. The most characteristic symptoms of the disease are the severe reduction of internodes of affected branches, accompanied by suppression of the reproductive phase in spiked branches, including phyllody of flowers. The colour of the leaves also changes to yellowish and finally reddish largely before death. Ratio between length and breadth of the spiked leaves is almost double of that of healthy leaves. Calcium/nitrogen ratio in leaves and twigs of the diseased trees is lower than in healthy ones. The disease symptoms do not normally manifest themselves all over the affected tree simultaneously with the onset of the disease. The diseased trees are killed within two to three years after infection. The disease symptoms, may, however, remain masked and can be forced out by pollarding the trees or pruning of some branches. The disease causes death of root ends and haustorial connections. The disease was first reported in 1899. It is progressively spreading throughout the whole southern part of Karnataka and adjoining areas of Tamil Nadu and Andhra Pradesh. In natural forests radial spread of the disease is commonly encountered. Isolated distant spread is rare. Trees of all ages and sizes are attacked and succumb to the disease.^{1,2}

46.7.28 Till the early sixties, the spike disease was considered to be of viral origin because no casual organism could be found asso-

¹ Sen Sarma, P. K., 1975 (April). Spike Disease of Sandal—An Yellows Type of Disease. A Paper submitted to the Second World Technical Consultation on Forest Diseases and Insects, New Delhi.

² 1965. Report of the Second Expert Committee on Forest Research Institute & Colleges, Dehra Dun, New Delhi, Ministry of Agriculture, Government of India.

ciated with it and it was experimentally transmissible by bud and patch graft. Attempts at controlling the disease by lopping sandalwood trees and removing those that showed the symptoms had only limited success. A considerable amount of biochemical and physiological work was also done. The Second Expert Committee¹ based their recommendations on the various characters of the disease, and suggested different measures in order to apply modern virological techniques to isolate the virus, purify it, determine its diagnostic characteristics and to explore the possibilities of culturing it on other easily handled plants. Several directions of research suggested were: (a) testing of large population of progenies for resistance to the disease in the hope of isolating resistant individual, (b) use of systemic and other insecticides to kill the vectors, if any, (c) study of the methodology of transmission of the disease, (d) finding of index hosts useful for checking presence of latent or masked infection, (e) possibility of preparing an antiserum to the virus, (f) chemotherapy for control of the disease, (g) use of the mild strains of the virus, etc.

46.7.29 Discovery in the late sixties that many yellows types of diseases are caused by mycoplasma-like organism (MLO) led to the suspicion that the causal agent in sandal spikes might be MLO. At present the Bangalore centre of the FRI, in collaboration with the IARI, is carrying on researches on sandal spikes entirely on the theory that the disease is caused by MLO. Electron microscopic examination is reported to reveal the presence of MLO's in the leaves of some of the affected plants. Tetracycline therapy is also reported to confirm that the disease is caused by MLO. No solution has, however, yet been found to control the disease by any of the methods adopted for treatment of plant disease of mycoplasmal origin. Elimination of collateral hosts of disease pathogen, control of insect vector/vectors, chemotherapeutic treatment of the diseased trees at the early stage of the disease and removal of badly affected trees (to reduce the source of infection) have been suggested² as the only alternative at present to minimise the losses.

46.7.30 Although spike disease of sandal has been under investigation for several decades all attempts to control the disease have proved infructuous so far. Unless a strong and concerted multidisciplinary research programme is formulated, it may not be possible to save the sandalwood trees, thereby affecting an important foreign exchange earning oil distillation industry. We recommend that problem-oriented

¹ 1965. Report of the Second Expert Committee on Forest Research Institute & Colleges, Dehra Dun, New Delhi, Ministry of Agriculture, Government of India.

² Sen Sarma, P. K., 1975. Spike Disease of Sandal—An Yellows Type of Disease. A Paper presented to the Second World Technical Consultation on Forest Diseases and Insects, New Delhi.

multidisciplinary research centre for sandal spike disease should be established by the Government of India.

46.7.31 There is need to energise research on marine organisms with reference to their effect on timber. Timber is an ideal construction material for structures in the sea. India has a seaboard of about 5,600 km and so a considerable quantity of wood is annually used for jetty piles, catamarans, coastal and fishing vessels, for boat building and in the installations of the Navy. In view of the acute shortage of timber, a judicious utilisation of timber resistant to attack by marine borers is necessary. There has been some preliminary work on the 'primary film', its composition and various factors influencing the settlement of larvae of borers and foulers. Also some preliminary studies have been conducted on the occurrence of marine fungi infecting timber. It is understood that services of the international experts through FAO were obtained in this regard and the research fellowships granted by the FAO.

Problems in Industrial and Utilisation Research

46.7.32 India abounds in tropical hardwoods, and in many forests the composition is a mixture of a large number of species. Reliable basic data are available only for a small fraction of the number of tree species that constitute the timber wealth of the country. For instance, in the Andaman forests (tropical evergreens and semi-evergreens) only a few species, constituting not more than 25 per cent of the total growing stock, have marketable value and are classed as 'commercial timber'. Some of the remaining stock sometimes finds a market as 'non-commercial timber', but mostly these are wasted as there is no demand for fuel in the Islands.

46.7.33 In some relatively high rainfall temperate hardwood forests in Eastern India, the same lack of knowledge is noticed in the matter of the best economic utilisation of the large number of species that constitute such forests. For instance, a recent study of the Darjeeling hill forests¹ showed that even after separately accounting for 32-33 different species, about 24 per cent of the total growing stock of timber (breast height girth 91 cm and over) was contributed by miscellaneous species. Again about 15 per cent of the total volume was contributed by *sungre katus* (*Quercus pachyphylla* Kurz), whose only use now is in the making of charcoal. While preliminary experiments may have shown its better economic use in the panel industry, there is still a lot of leeway to be made up in utilisation research on, and

¹ Guhathakurta, P., 1973 (March). A study of the Forest Resources of Darjeeling Forest Division, Part I, Bulletin 47, Planning and Statistical Cell of the Chief Conservator of Forests, West Bengal.

development of, this species. More and more detailed inventory data would start coming, when a project approach for implementing production forestry programme is adopted. These data would indicate incidence of different species in the composition of growing stock. While silvicultural and management research on many of the indigenous species can be carried out, the results cannot be applied without a simultaneous research on wood structure, properties, utilisation, etc. of many silviculturally promising species. Intensive research should be undertaken to grade the different hardwood species with regard to their suitability for different industrial and constructional uses. When used for constructional purposes, additional information must be obtained as regards the seasoning behaviour and durability of the species.

46.7.34 Since the responsibility for utilisation research would be of the Central Government and the task is heavy, the FRI alone would hardly be able to cope with the research work. The intensification of utilisation research is particularly needed in the Andaman & Nicobar Islands. In Chapter 42 on Production and Social Forestry we have recommended that the Central Government should set up a well-equipped research institute in the Islands.

46.7.35 There is a large gap in the knowledge of utilisation of minor forest produce (MFP). We have analysed the importance of MFP in Chapter 43 on Minor Forest Produce, and referred to the need of research on different aspects of utilisation of MFP. Owing to the lack of knowledge of the availability, scientific methods of collection, drying, processing, grading, packing, storage, etc., sub-standard materials reach the market. Very often many of the products remain unexploited for want of knowledge on marketing and utilisation. Development of many of the MFP (through cultivation) needs attention and optimum methods of cultivation and exploitation have to be evolved and economics worked out. In Chapter 43, we have cited the example of *Sterculia urens* Roxb. (Yielding gum *karaya*). Export of the product cannot perhaps be increased without going in for plantations of this species.

46.7.36 The plywood industries have a research institute of their own at Bangalore. The soap-making industries also take up research on minor oilseeds of tree origin. There is, however, one aspect of industrial research which can be profitably initiated in forest research institutes, namely the pulping characteristics of hitherto unutilised species, or of species currently utilised under different planting density, age and thinning regimes. Other important topics of industrial research are development of particle boards for tropical climate, preparation of design/data for plywood, hardboard, particle boards, sawmilling and wood working machinery, development of high yield process for pro-

duction of paper and paperboard for packaging from indigenous forest raw materials, etc.

46.7.37 One of the difficulties faced by the plywood industry is the non-availability of the listed plywood species conforming to a rigid specification as regards size and shape. Enlarging the list of acceptable plywood species through research is of great importance. Bigger sized logs are gradually getting scarce in areas where the plywood factories generally exist. Research on the economic utilisation of logs of smaller girth is necessary, and the industrial design unit should take upon itself the task of developing machinery design for this purpose.

46.7.38 A recommendation made in our Interim Report on Forest Research and Education is for setting up a well organised unit of industrial design, to expedite commercial exploitation of proven pilot experiments. The unit can, and should, play a key role in developing an 'economic' unit for industries, particularly the pulp and paper industry. At present, western technology is generally followed, and the minimum 'economic' size of a plant is generally considered to be such as can produce a fairly high tonnage daily. An economic plant of western standard would require a large industrial catchment. In view of the relatively small extent of forests at any one locality in India and in view of the local demands that are placed on such forests, it may not always be possible to carve out a forest catchment for a big mill. Moreover, a bigger mill has a higher gestation period, and generally the foreign exchange component for machinery is pretty high. The consultants that are generally employed by the Government for making feasibility studies are almost invariably oriented toward western technology, which requires a high capital investment per caput employment. India has considerable scientific and technical manpower, and the challenge of making comparatively small (and less capital-intensive) mills economic can certainly be accepted by them. We have earlier in Chapter 42 on Production and Social Forestry referred to the concept of mother pulp mills and baby paper plants being talked about in the industrial circles. Where conditions are suitable and a large extent of undeveloped forest area exists, 'economic' pulp mills to employ western technology can certainly be thought about. But for many States or parts of the country, research should be taken up for finding out processes and designs of machinery, by which it is possible to make small pulp and paper mills economic too. The unit of industrial design, that we visualise, should take up the job as a challenge.

46.7.39. A collaboration with the CSIR in utilisation and industrial research should be established. Utilisation research on some items of MFP, industrial research on development of particle boards with a mixture of indigenous species suited to tropical conditions, and design of machinery for 'economic' pulp and paper mills of lower

capacity are some of the items that may be pursued as collaborative ventures.

Problems in Forest Management and Operations Research

46.7.40 As regards forest management and biometry, the major work consists of compilation of volume tables, yield and stand tables and the studies on spacing, thinning and pruning. These will remain important components of study, as progressively better utilisation of hitherto non-commercial species becomes possible and silvicultural researches are successful in the reproduction of such species. For such species and even for known commercial species, the productivity under different thinning and management techniques should engage more intensive attention.

46.7.41 In the marketing of forest products, a study is required on the current position and research on future possibilities. There would be two facets of the study and research—'current and prospective supply' and 'current and prospective demand' of goods and services from forests. Both are essential for planning, and we have elaborated them earlier in Section 2 of this chapter.

46.7.42 In forest economics, research should be guided more by the problems that may be thrown up in the process of implementation of the programmes of production forestry, social forestry, development of minor forest produce, desert development, etc. For instance, the States would need to carry on studies (and most of them are not equipped for that) on correlation between costs and returns from plantations—short and long rotation—in different productivity zones. Economics of wind-breaks and shelter-belts for projecting the social forestry programme to the farmers are also to be urgently taken up. Another important study on forest economics concerns the optimum level of mechanisation, use of improved logging tools, etc. in different areas of the country. Some of the areas of study in forest statistics have already been indicated earlier in Section 3 of this chapter.

46.7.43 In the matter of logging, the main thrust so far had been in the studies on the efficiency of basic logging tools. The Logging Training Centres Project also places an accent on basic logging with improved hand tools. An assessment of the basic logging works is at present called for. A lot of experience has also been gained in the matter of ropeway transportation—power-operated or by gravity. Greater use of such mechanical devices in future is inescapable. It should be possible to design and manufacture suitable equipment with hundred per cent indigenous materials for different types of ropeways to be used for logging in the hills for products like timber, veneer-

wood, pulpwood, etc. This practical aspect of research on logging should not be lost sight of.

A Revised Pattern for In-Service Education and Training

46.7.44 The higher forest Services include the Indian Forest Service (IFS) and the State Forest Services (SFS). In-service education and training for both these Services in the Indian Forest College run by the Central Government cover a period of two years. We do not recommend an extension of this period, but we do suggest that there should be a separate forest college (or even two) for the SFS. For both these services, the plan of in-service education and training should follow the same principles, but the course content should be carefully drawn up to account for the levels of responsibility that the officers of the two services would be required to discharge.

46.7.45 In the first year of the in-service education and training, a few basic courses would be compulsory for all recruits. The basic courses would be on: silviculture, forest management, mensuration, survey and engineering, forest harvesting and utilisation, wildlife management, biology, botany, and soil and water management. These basic courses should generally be followed by study in the field (i.e. during field tours). Extensive field tours should be undertaken in the first year in the forest with different formations, like coniferous, tropical evergreen, sub-tropical *sal* and teak forests, semi-arid areas, etc. It is our view that close field observations supplemented by written lectures notes would impart a basic but broad-based forestry knowledge to the students.

46.7.46 The research workers (including Directors), who are to undertake teaching also (as per our recommendations in the Interim Report), should teach the students the elements of the particular discipline during tours. Since the FRI and regional research institutes would have their research plots in the field, the research workers from these institutions would be able to combine research with teaching.

46.7.47 The second year would be mainly 'in residence', except for the students' association with problem-oriented field projects in the last six months as part of their dissertations. The curriculum should be organised into five divisions of instruction, namely management and resource control, inventory and planning, production and resource utilisation, wildlife and environment, and wood science. Each subject included in the respective divisions should be for advanced studies and formulated into courses at two levels. The higher levels of advanced courses would be meant for IFS students only, while the lower levels both for IFS and SFS officers.

46.7.48 Of the above five divisions, the division of management and resource control would be compulsory for all and would include advanced courses on silviculture, forest management, forest policy, forest law, forest protection, social forestry, working plans, erosion and its control and world forestry. Each student would have also to study subjects included in one of the other four optional divisions. The number of subjects in the optional divisions required to be studied by the recruits in the IFS and SFS should be determined by the Standing Committee on Forest Education and Training of the CFRE. An IFS probationer would be required to take up one of these subjects as a major, in which both the lower and higher levels of the advanced course should be completed. We believe that with this scheme of education and training, sufficient urge would be created amongst the students to choose a line of specialisation as recommended by us in our Interim Report on Forest Research and Education. Subsequent specialisation with higher studies in the FRI or in the universities would then be relatively easy. Assignment of the students to the different subjects in the optional divisions should not only be based on aptitude, but also "subject to the required needs of the scientific and technological 'inputs' in the specialised fields of forest management and research". In Appendix 46.7, we have given a diagrammatic representation of the scheme of in-service education and training for the higher forest Services (IFS and SFS).

46.7.49 Forest science is developing fast all over the world. In the utilisation field also, a rapid change of technology is taking place. It is necessary that forestry personnel at all levels are kept abreast with latest technological developments. We recommend that facilities for periodical training of officers at different levels on the Staff College pattern should be created in the FRI. Normally, a person being promoted to a higher post or a higher or a different kind of responsibility (e.g. posting in a forest corporation) should undergo the Staff College training, but the contents of such training course would obviously vary from one level to the other.

46.7.50 As in the case of higher Services, the in-service education and training for the Forest Rangers should include extensive tours in the field in the first year and 'in-residence' academic instructions in the second year. Departmental procedure and accounting should also form a part of their curriculum in the first year. In the second year, they would have to take a compulsory group of subjects, and another optional subject. The total number of groups, the subjects and the course content of each subject would obviously be of a lower standard than those for the higher Services. The Standing Committee on Forest Education and Training of the CFRE should device the scheme of education and training of Forest Rangers on the above principles.

46.7.51 We are not making any suggestions for reorientation of the courses for the training of Deputy Rangers/Foresters and Forest Guards. Since this is mainly field-oriented, each State should devise its own plan of training and update it periodically to best suit the local conditions. However, it is expected that the Standing Committee on Forest Education and Training of the CFRE would provide all necessary assistance.

8 SUMMARY OF RECOMMENDATIONS

46.8.1 Some of the more important recommendations contained in this chapter are summarised below:

1. A survey on the national scale of a more generalised nature should be a pre-condition for deciding priorities for the selection of areas for detailed pre-investment studies.

(Paragraph 46.2.5)

2. For working plans, particularly in areas where fairly intensive forest management is being practised, it is necessary to have maps on 1:15,000 or 1:25,000 scales. For normal forest management purposes, aerial photographs on 1:50,000 scale would suffice. In areas of special interest and for those intensively managed or under man-made forests, aerial photographs should be on 1:20,000 scale.

(Paragraphs 46.2.10 and 46.2.11)

3. Space photography from Indian scientific satellite should be used for rapid forest survey in areas which are little known.

(Paragraph 46.2.11)

4. A National Forest Survey organisation should be set up, and its programme should encompass the following elements: (a) resource analysis, (b) current and prospective supply of goods and services, (c) current and prospective demand for goods and services, (d) technical support services, and (e) methodological development.

(Paragraph 46.2.13)

5. For analysing current and prospective supply, some kind of permanent plot system that can be measured in part or in entirety over different periods should be established. Systematic sample and continued use of clustered ground sample should be used. Each unit in a cluster should cover a relatively large area.

(Paragraphs 46.2.16 and 46.2.17)

6. Adequate information should be collected on growth, mortality, cull, increment and removal rates, as also data for pricing of future timber supplies.

(Paragraph 46.2.19)

7. Changes and trends in wood use over time, as well as absolute amounts, should be determined; and this information should be used along with census data etc. to make estimates of aggregate present and future wood requirement. An iteration between supply and demand at various price levels should be done.

(Paragraph 46.2.20)

8. A National Forest Information System should be developed, to act as a data bank in respect of information required for planning, implementation, evaluation and modification, as and when required.

(Paragraph 46.2.23)

9. While the coverage, accuracy and breakup of the data for different levels would be different, there should be a common layout and format so that data could readily flow from the district or project level to the State and regional level and then to the national level.

(Paragraph 46.2.26)

10. For building up an efficient national forest information system, the requirements are: (a) national forest inventory. (b) national timber trend studies, and (c) data processing.

(Paragraphs 46.2.29 to 46.2.32)

11. The standard forms for collection of forestry statistics should be revised and re-grouped into: (a) periodic forestry statistics, and (b) annual forestry statistics. The collection of periodic forestry statistics should be so organised that the data collected prove useful for formulating the five year plans. Annual forestry statistics should be collected from different sources.

(Paragraphs 46.3.7 and 46.3.8)

12. The Chief Conservator of Forests and the crop reporting authority at the State level should get together and take steps to eliminate the discrepancy in the statistics of area under forests. Clearcut procedures should be laid down for updating of the records every year and publication of one set of figures by both the agencies.

(Paragraph 46.3.10)

13. Production statistics should be improved in quality and their scope enlarged.

(Paragraph 46.3.11)

14. Movement of forest produce from one State to another should be collected by sample studies undertaken in the concerned sectors of the industry.

(Paragraph 46.3.12)

15. Steps should be taken for improving, in quality and scope, price and cost statistics for forest produce in the manner suggested in the text.

(Paragraphs 46.3.13 and 46.3.14)

16. Detailed data of labour employment in various forestry activities and forest industries should be collected and assessed.

(Paragraph 46.3.16)

17. For coordination and linking of the forestry activities with other activities in the district, the data from the forest divisions should be collected in such a manner as to enable them to be split or combined by districts.

(Paragraph 46.3.18)

18. For achieving the national growth goals, there should be three distinct levels in planning — (a) national plan, (b) regional or State plan, and (c) local plan. Planning could be both from the top at the national level or from the bottom at the local or project level. The national production goals should be split into regional targets. The latter in turn should be split into local targets with a view to producing specified products from specified areas. The core industry and its location should be identified in advance, so that the development of forestry production programme through local or project plans could be planned around such a core industry.

(Paragraphs 46.4.6, 46.4.7,
46.4.11 and 46.4.15)

19. As far as possible, the area management plan should be replaced by purpose or production or industry oriented project plan.

(Paragraph 46.4.18)

20. An industry oriented management plan should be designed for the production of fixed quantities of the raw materials of the prescribed specifications to cater to the requirements of the industry or industries with which the plan is linked. Maximum utilisation of the various products and by-products from the same area or the same tree should be an essential feature of the plan. There may be different area coverages for different types of raw materials, when required by the same industry.

(Paragraphs 46.5.2, 46.5.5
and 46.5.10)

21. The satisfaction of the bonafide domestic needs of the local community, from the operational area itself or from separate areas reserved for the purpose should be a part of the industry oriented management plan.

(Paragraph 46.5.7)

22. Creation of local employment should be specifically taken care of in the preparation of industry oriented management plans.

(Paragraph 46.5.8)

23. The biological requirement of the species occurring or the species that are proposed to be introduced should be the primary con-

sideration in the formulation of the industry oriented management plans.

(Paragraph 46.5.9)

24. The provision of financial and other inputs, including staff and equipment, should form an integral part of the sanction of the plan by a competent authority.

(Paragraph 46.5.12)

25. The first phase of the industry oriented management plan should be the optimum utilisation of the existing crop (crop I). The second crop (crop II) need not be a reproduction of the original crop but should be planned for the actual requirement of the existing and projected industries.

(Paragraphs 46.5.13, 46.5.14
and 46.5.15)

26. There should be a Division of Forest Inventory, Planning and Evaluation under the Inspector General of Forests, headed by an Additional Inspector General of Forests. The Division should have two wings, each in charge of a Chief Coordinator in the rank of Deputy Inspector General of Forests: (a) national forest survey, and (b) planning cell as recommended in the Interim Report on Production Forestry — Man-made Forests.

(Paragraphs 46.6.1 and 46.6.2)

27. National forest survey organisation should be built up by expanding the existing Pre-Investment Survey of Forest Resources. The entire forest area should be surveyed every 10 years.

(Paragraphs 46.6.3 and 46.6.4)

28. A pattern should emerge in which the States would be responsible for collection of statistical data sought for by the regional units of the Central Government, who would process and analyse the data and maintain the information bank for feeding the States with the necessary data and assisting them in their planning work. In the States, resources survey and planning organisations should be created.

(Paragraphs 46.6.13 to 46.6.15)

29. There should be an Advisory Council at the Centre to advise on the policy of forest surveys and priority to be assigned and to provide necessary coordination with the concerned industries.

(Paragraph 46.6.16)

30. There should be regional technical committees, one for each region, to decide the details on technical working, inter-relationships of forest surveys with local plans and connected matters and to suggest priority for surveys.

(Paragraph 46.6.17)

31. Specific action in the matter on Centre-State coordination in forest development planning should be taken as suggested.

(Paragraph 46.6.19)

32. Statistical organisations should be set up in the State Forest Departments in the manner suggested in the text. The existing statistical unit in the Central Forestry Commission should be developed into a fulfilled statistical division.

(Paragraphs 46.6.20 and 46.6.21)

33. The regional technical committees, to be set up by the Council of Forest Research and Education for identification of research problems, should consider, and give due importance to, the topics of research indicated in broad outlines.

(Paragraphs 46.7.18 to 46.7.43)

34. Problem-oriented multidisciplinary research centres should be established by the Central Government for research on (a) latosols *vis-a-vis* forest management practices, and (b) sandal spike disease.

(Paragraphs 46.7.22 and 46.7.30)

35. The unit of industrial design, the establishment of which has been recommended in the Interim Report on Forest Research and Education, should design machinery for developing economic units for industries, particularly for utilisation of logs of smaller girth by the plywood factories and for the establishment of small economic pulp and paper mills.

(Paragraphs 46.7.37 and 46.7.38)

36. A collaboration with the Council of Scientific and Industrial Research should be established in utilisation and industrial research.

(Paragraph 46.7.39)

37. There should be one or two separate college(s) for the in-service education and training of officers recruited to the State Forest Services.

(Paragraph 46.7.44)

38. The suggested revised pattern of in-service education and training for the higher forest Services should be introduced.

(Paragraphs 46.7.44 to 46.7.48
and Appendix 46.7)

39. Facilities for periodical training of officers of different levels on the Staff College pattern should be created in the Forest Research Institute & Colleges, Dehra Dun. Normally, a person being promoted to a higher post or a higher or a different kind of responsibility should undergo the staff College pattern training.

(Paragraph 46.7.49)

APPENDIX 46.1

(Paragraph 46.3.3)

Prescribed Returns of Indian Forest Statistics

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(to be compiled in the Directorate of Economics and Statistics,
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APPENDIX 46.F—*Concl'd.*

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- 7.7 Games shot in forest area
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Appendix—Result of *van-mahotsava*.

APPENDIX 46.2

(Paragraph 46.3.5)

Forestry Statistics Returns, Standardised by the Central Forestry Commission

- I. Forest area statistics: (a) by ownership, (b) by legal status, (c) by composition, (d) by functions, (e) by management status, (f) alteration in forest areas, (g) by silvicultural treatment, (h) area under man-made forests — coniferous and non-coniferous, and (i) area naturally regenerated — coniferous and non-coniferous.
- II. Outturn statistics of wood, bamboo and other minor forest produce: (a) industrial wood, coniferous and non-coniferous separately — (i) saw logs, veneer logs and logs for sleepers, (ii) pit-props and pulpwood and (iii) other industrial wood, n.e.s., (b) fuelwood, including wood for charcoal, (c) removal of bamboo, (d) conversion product of timber in true volume — sleepers and other sawn timber separately, (e) removals of wood and bamboos by (i) departmental agency, (ii) purchasers and (iii) right/lease holders and free grants, and (f) outturn of minor forest produce other than bamboos — (i) material for tanning, (ii) material for plaiting, (iii) oil-seed and (iv) othes — *tendu* (*Diospyros melanoxylon* Roxb.) leaves, pine resin and gum *karaya*.
- III. Statistics relating to industries — (a) pulp and paper industry, (b) match-wood industry, and (c) panel products — (i) plywood, (ii) fibreboard, and (iii) particle board.
- IV. Forest revenue and expenditure statistics.

APPENDIX 46.3

(Paragraph 46.3.9)

Discrepancy in Forest Areas According to Indian Agricultural Statistics and Indian Forest Statistics during 1970-71

('000 ha)

State	Forest area 1970-71		Increase (+) of decrease (—) of forest area figures over Indian Agri- cultural Statistics	
	Indian Forest Statistics ¹	Indian Agricul- tural Statistics ²	Absolute	Percentage
1	2	3	4	5
Andhra Pradesh	6,496	6,337	+159	+2.51
Assam (including Meghalaya & Mizoram)	4,506	3,565	+941	+26.40
Gujarat	1,739	1,634	+105	+6.43
Himachal Pradesh	2,144	2,782	—638	—22.93
Jammu & Kashmir	2,104	2,776	—672	—24.21
Madhya Pradesh	16,885	14,459	+2,426	+16.78
Maharashtra	6,618	5,417	+1,201	+22.17
Karnataka	3,510	2,890	+620	+21.45
Orissa	6,746@	4,973	+1,773	+35.65
Rajasthan	3,690	1,355	+2,335	+172.32
Tamil Nadu	2,248	2,013	+235	+11.67
all India	74,772	65,978	+8,794	+13.33

¹ Based on provisional data in the Bulletin Forestry in India, 1969-70 and 1970-71, New Delhi, Directorate of Economics & Statistics, Ministry of Agriculture, Government of India.

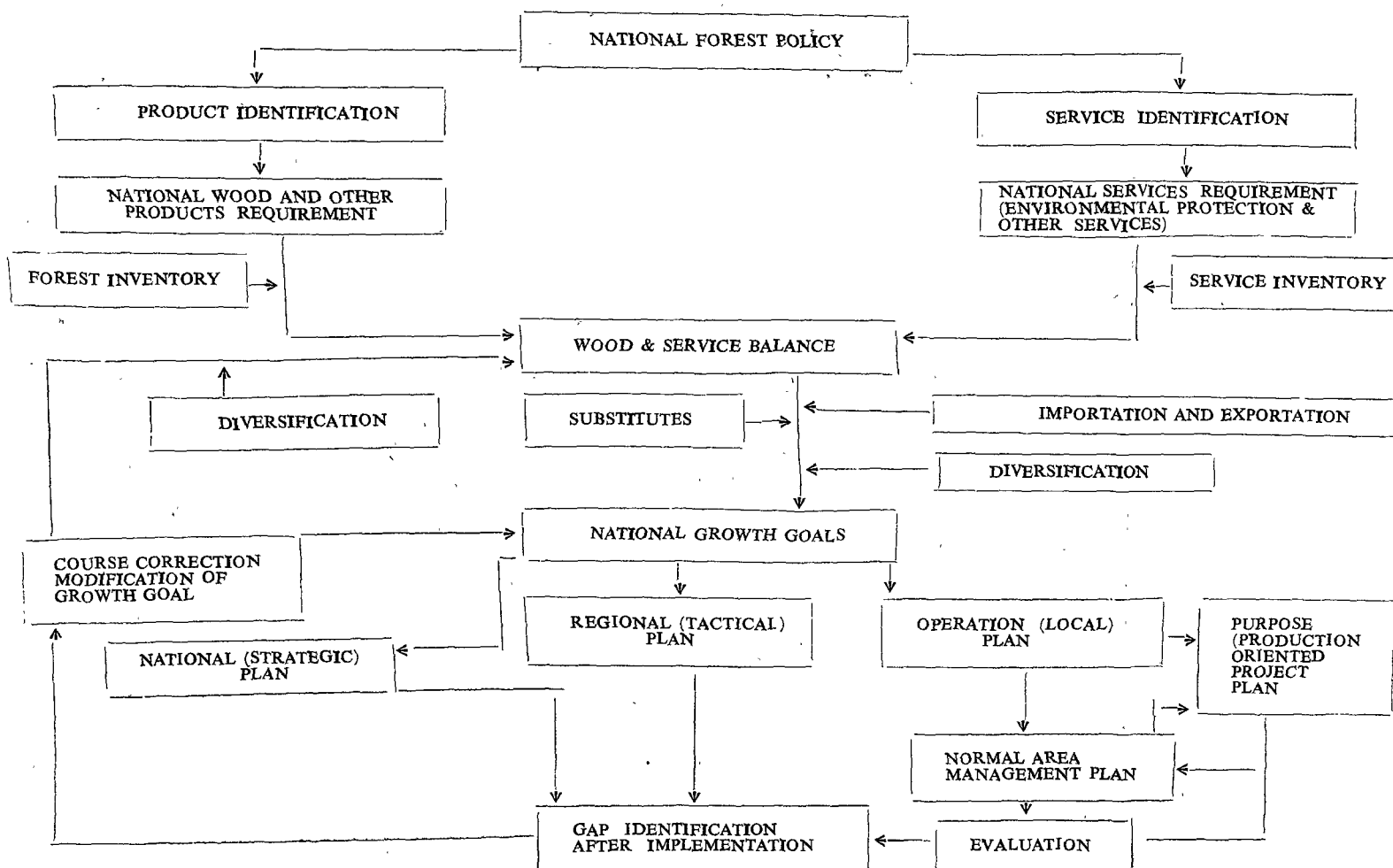
² Based on provisional data in the Bulletin Classification of Area & Irrigated Area, 1971-72, New Delhi, Directorate of Economics & Statistics, Ministry of Agriculture, Government of India.

@1968-69 figures repeated.

APPENDIX 46.4

(Paragraph 46.4.18)

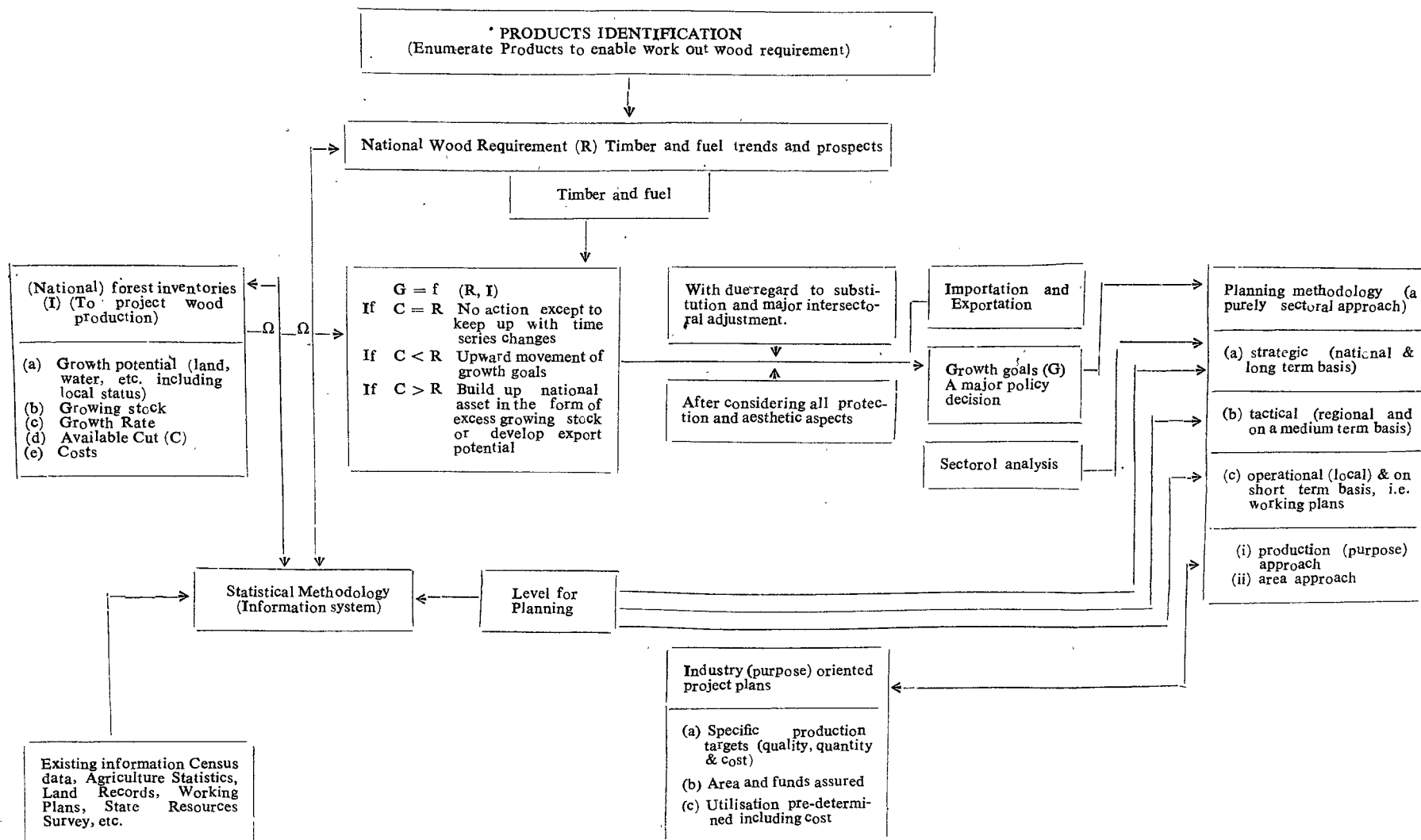
Planning Commodity Production and Data Requirement



APPENDIX 46.5

(Paragraph 46.4.18)

Flow of The Requirements for Forest Planning, Evaluation and Re-appraisal



APPENDIX 46.6

(Paragraph 46.5.16)

Illustration of an Industry Oriented Management Plan of Bastar Region,
Madhya Pradesh

The illustration is taken from an Intensive Forest Management Plan of Bastar region, Madhya Pradesh for the period from 1974-75 to 1984-85. The region has been divided into two industrial catchments — Barsur and Jagdalpur. Summary of the contents of such a plan for Barsur industrial catchment is given, highlighting the distinctive provisions made in the concerned plan.

2. According to a survey of Bastar forests done by the Pre-Investment Survey of Forest Resources (PIS), the forests carry a growing stock of 187 million $m^3(r)$ of wood and 4.28 million tonnes of bamboos. The forests comprise 3 per cent of the total area of forests in the country and 7.19 per cent of the total growing stock. Even under conservative management, these forests can yield 3.14 million $m^3(r)$ of wood and 0.32 million tonnes of bamboos yearly. But upto now, the annual harvesting has been restricted mainly to the removal of about 195,000 $m^3(r)$ of timber in view of the fact that there is practically no utilisation of industrial wood, other than *sal*, teak and *bija* (*Pterocarpus marsupium* Roxb.) timbers. The region faces effective demand limitations to dispose profitably some of its forest products — fuelwood, pulpwood, poles and secondary timber species. The current high cost of extraction and non-utilisation of the low-priced products are attributable to the single product (timber) approach towards the utilisation of the forests. The selective system of forest management cannot create any demand or generate large scale economic activities.

3. Industrial pre-requisites and comparatively developed infrastructure existed close to Barsur town. Accordingly it was considered as one of the potential industrial sites. Fellingings around Barsur would reduce the delivery cost of industrial wood per unit volume, which would act as an incentive for industrialisation of the area and utilisation of these produce. Therefore, Barsur industrial catchment on the Jagdalpur plateau was carved out with a total forest area of about 2,454 sq km, of which about 1,326 sq km was reserved forests and 1,128 sq km protected forests. As in the case of conventional working plans, description of the area, composition and conditions of the forests, statistics of growth and yield, past forest management, and staff and labour supply have been discussed and conclusions drawn. A summary of the contents of the other chapters is given in the following few paragraphs to illustrate the approach as distinct from conventional working plans.

Demand Analysis

4. Factors responsible for restricted demand, poor marketability and severe under-utilisation of inferior materials, which constitute the bulk of the total standing volume, are: (a) inadequate development of transportation infrastructure, (b) lack of wood based industries in the region, (c) meagre local demand due to sparse population and low per capita income, (d) current policies of sale by auction, leaning heavily on the purchasers (In conditions pre-

vailing in Bastar district, the off-take of produce by purchase through auction system is limited to the lifting capacity of the intermediate traders. Any processing unit or industry needs an assured supply at comparatively stable prices. Marginal utility products and unutilised products can only be disposed of by advance negotiated sales), (e) unrealistic fixation of stumpage prices for inferior material, left unexploited in the present working system, (f) absence of long term contract, (g) scattered fellings, and (h) failure to attract purchasers for materials obtained from large scale clearfellings in the interior. The products that would be normally available from the plan area were classified into (a) sal, (b) teak, (c) miscellaneous species, (d) mixed hardwoods for pulping and fuelwood, and (e) bamboos. Statistics were collected and reproduced for the average sale during 1971-72 and 1972-73, both in volume and price, for the different products identified. Pulping tests on laboratory and pilot plant scales were carried out and they indicated suitability of a mixture of 11 to 36 of the more abundant species (accounting upto 80 per cent of the available volume) for giving bleached sulphate pulp from which printing/writing grade paper could be made, with properties comparing favourably with those of paper made only from bamboo. Laboratory scale tests in India with a mixture of 36 hardwoods gave rayon grade pulp of some promise. More elaborate tests carried out subsequently in the UK established that bleached pulp of high alpha cellulose content can be readily prepared, but with high resin and inorganic contents and not very good viscose filterability. Most of the hardwoods proved unsuitable for making mechanical pulp acceptable for newsprint manufacture. However two species, *Terminalia alata* Heyne ex Roth, syn. *T. tomentosa* W. & A. and *T. arjuna* W. & A. which make up more than 30 per cent of the total standing volume, gave better mechanical pulp than *Boswellia serrata* Roxb., which is used at present in Nepa Mills.

5. In order to fix the future production targets, the plan took into account the all-India demand outlook of industrial wood, regional demand and price, and local demand and price. In the regional demand and price study, the main regional markets were surveyed and the trade handled in the markets together with past and current prices were collected and reproduced. An estimate was also made for the expected demands in the regional markets in 1980. Similarly statistics were collected for local demand and prices.

6. An assessment of expected developments was made, and it was found that a breakthrough in the disposal of industrial wood is expected due to the following reasons: (a) there is a world-wide shortage of paper and newsprint, (b) substantial amounts have been earmarked by the Planning Commission for housing and rural electrification during the Fifth Plan, and these projects would require massive quantity of timber and poles, (c) interest has been shown by different entrepreneurs for setting up panel, rayon and paper industry in the region, and it was expected that the envisaged industries would utilise hardwood fuel in place of coal, and (d) acute shortage of energy and chemicals in the country was likely to induce the process of destructive distillation of wood in the area. The management plan have identified the steps necessary for promoting demand.

Proposed Forest Management.

7. The plan aims at intensive forest management which involves parallel and synchronised investigation of all closely interrelated factors of production of specified forest produce at the most economical cost, formation of new crop, assessment of interaction between forestry and non-forestry plans and financial viability of all operations. The plan prescriptions are flexible enough to supply increasing quantities of industrial wood, at the same time keeping in view the need for meeting the rights and concessions of the local people. It seeks increased generation of productive and gainful employment of the tribals in their traditional environment.

8. Favourable forest growing conditions open numerous possibilities as to the species that are likely to grow well in the area. Technical forestry alternatives were considered both from silvicultural and demand-supply aspects and three species were tested for profitability, viz., *sal*, teak and *chir* pine. Reasons for selection of each were analysed. *Eucalyptus* has been excluded for the reasons that (a) its likely outlet is in the form of short fibre pulpwood which is available in the area and would continue to be available in the coming decades, and (b) its plantation is uneconomical at the prevalent prices. Bamboo would be encouraged as an understorey in *sal*, teak and left-over patches in pine plantations. In view of the acute shortage of industrial wood in the national and regional markets and severe fluctuations in the cost and price items all fiscal calculations were projected for a short period of 10 years. For selecting technical forestry alternatives, different rotations were adopted.

9. Profitability analysis was made on three criteria, namely internal rate of return (IRR), net present value (NPV) and benefit/cost (B/C) ratio. It was found that in effect *sal* out-performs teak in terms of B/C ratio, while teak out-performs *sal* in terms of NPV. At the same time the IRR does not show clear advantages for either of the alternatives. Under the circumstances, the choice of alternatives could be strongly influenced by non-quantifiable considerations. Rather than exclude either, a combination was chosen so as to confine *sal* to its best sites, teak to high pH soils comparatively away from industrial sites, while reserving the balance for pine.

10. Methods of treatment to be adopted led to the formation of the following working circles: (a) *Sal* High Forest Working Circle, (b) Teak Plantation Working Circle, (c) Pine Experimental Plantation Working Circle, and (d) Bamboo Overlapping Circle.

11. The operations prescribed under the plan have been classified into commercial, semi-commercial and non-commercial ones. The commercial working has envisaged high investment economic forestry for the production of specified raw material to cater to the industrial and other requirements. The working of *sal* conversion (PBI area), teak and pine plantation operations would thus be commercial, and the rest of the operations semi-commercial and non-commercial. The semi-commercial working has been prescribed to cater to a few selected forest products. The non-commercial working has been prescribed for meeting the bonafide requirement of forest produce for the local population.

12. In order to introduce commercial working strictly within the framework of economic and financial limits, operational plans have been prepared for each centre of working in a project form, so that these plans completely meet the requirements of financial institutions and permit an insight into the relative importance of the variables within the realm of forest management. In addition, technical reports were prepared separately as a part of the plan to show detailed area, stand and volume information, extent and location and outturn estimated for each annual coupe, etc. for each of the important identified products. The semi-commercial and non-commercial working under the plan would have to be attended to under the normal budgetary procedure.

13. A pattern of industrial supplies has also been worked out. Industrial wood will be supplied mainly from concentrated regeneration areas. In the coming 30 years all these areas would be planned within a radius of 80 km from the envisaged industrial site near Barsur. *Nistar* and other non-commercial supplies will be met from selection and improvement working areas.

Management Plan for Working Circles

14. Prescriptions for different working circles have been given under the chapter headings "Management Plans". The identification of area to be put under *Sal* High Forest Working Circle was done on the basis of the facts that the area contains one of the finest *sal* forest with preponderance of mature stems having adequate regeneration or advance growth, that soil erosion is not a problem if clearfelling is adopted, that frost is unknown to the area and that grazing is not a problem. For calculation of rotation and conversion period, a partial benefit/cost analysis was adopted to determine the economics of rotation, which worked out as 70 years. However, for want of necessary experience in exploitation and re-stocking of extensive areas and marketing of inferior material in bulk quantities, a longer conversion period of 120 years was adopted on practical considerations.

15. Twelve periodic blocks (PB) of 10 years each have been constituted. PBI and PBII have been distinctly allotted and the remaining PB combined and called PB unallotted. In the PBI area, area, yield is prescribed to the regulated both by area and volume. Detailed ground inventory was conducted for the area and information of growing stock, estimated annual outturn, etc. indicated in a technical report referred to earlier. Precision limits of the estimate have also been indicated. In PBII area, only maintenance operations and induction of regeneration on purely silvicultural line would be attempted without any consideration of yield. The yield would be regulated by area. In PB unallotted, it has been prescribed to carry out selection-cum-improvement working and thinnings to be regulated by area. Sequence of fellings in PBI and PBII has been prescribed and clearly indicated.

16. In working PBI area, it has been prescribed that a treatment map of the annual coupe would be prepared by a gazetted officer. Four treatment types have been recognised, with details being given in the concerned technical report. In addition to the above, the management plan for the working circles indicate the prescriptions for PBI area and detailed procedure for marketing, felling and logging, extraction, regeneration operations, subsidiary cultural

operations, thinning in regenerated crop, protection and maintenance, operations to be carried out in other periodic blocks, etc.

17. The allotment of area to Teak Plantation Working Circle was based on availability of site with better quality away from industrial site and containing natural sporadic teak trees. Calculation of rotation at this stage has not been considered necessary. A period of 50 years for plantation programme has been adopted on the basis of economic calculation. Other prescriptions have been detailed to make it possible to take up large scale teak plantations and maintain them properly.

18. For Pine Experimental Working Circle, the area chosen has better quality forests with deep clay loam or sandy loam soils rich in microbial population with good deposits of organic matter and low pH. The area is situated at over 300 metre in elevation around 20 km radius from Barsur industrial site. A 40-year plantation programme has been adopted. It has been prescribed under Bamboo Overlapping Working Circle that there would be three industrial, two commercial and one *nistar* bamboo felling series, because of three distinct uses of bamboos, viz., industrial, commercial and *nistar*.

Economic Justification

19. Commercial Working was tested for its profitability. Three parameters, viz., B/C ratio, NPV and IRR were used to test normal and increased benefits and costs. To frame this evaluation, the boundaries of the analysis and the entities to which costs and benefits are to be referred to have been analysed beforehand. For instance, the boundaries of the analysis were fixed by the criteria that costs of road developments, construction of buildings, provisions for electricity and water would be imputed as project costs. But as regards bigger wood processing industries, they have not been considered as part of the project for imputation of costs, though they are very much connected with the utilisation of the produce.

20. The economic assessment was confined only to such areas which were to be worked purely on commercial basis, i.e. the following in the case of the plan being considered: (i) PBI area of *sal* forests, (ii) teak plantation areas, (iii) pine experimentation plantation areas, and (iv) commercial bamboo felling series. The prices and costs were taken at two levels. In the first instance both the items were taken at their current or anticipated market (or institutional) rates and normal discount rate applied. In the second, prices and costs were depreciated at social rate of discount. The following figures were arrived at :

	Social (or national) level	Commercial level
	discount rate 10 per cent	discount rate 12 per cent
B/C ratio	1.12	1.11
NPV	69.09	58.77
IRR	22.00	22.00

21. Sensitivity analysis was carried out to find changes in project profitability, both for selected price variables and selected cost variables. In the former, price variables were considered separately for teak, ply logs, saw logs, poles and pulpwood. In the case of cost variables, the items separately considered were costs for exploitations, transportation, plantation and regeneration and establishment. In doing so, only such variables were considered as constitute significant components of profitability calculation. Changes were calculated for both the discount rates mentioned above.

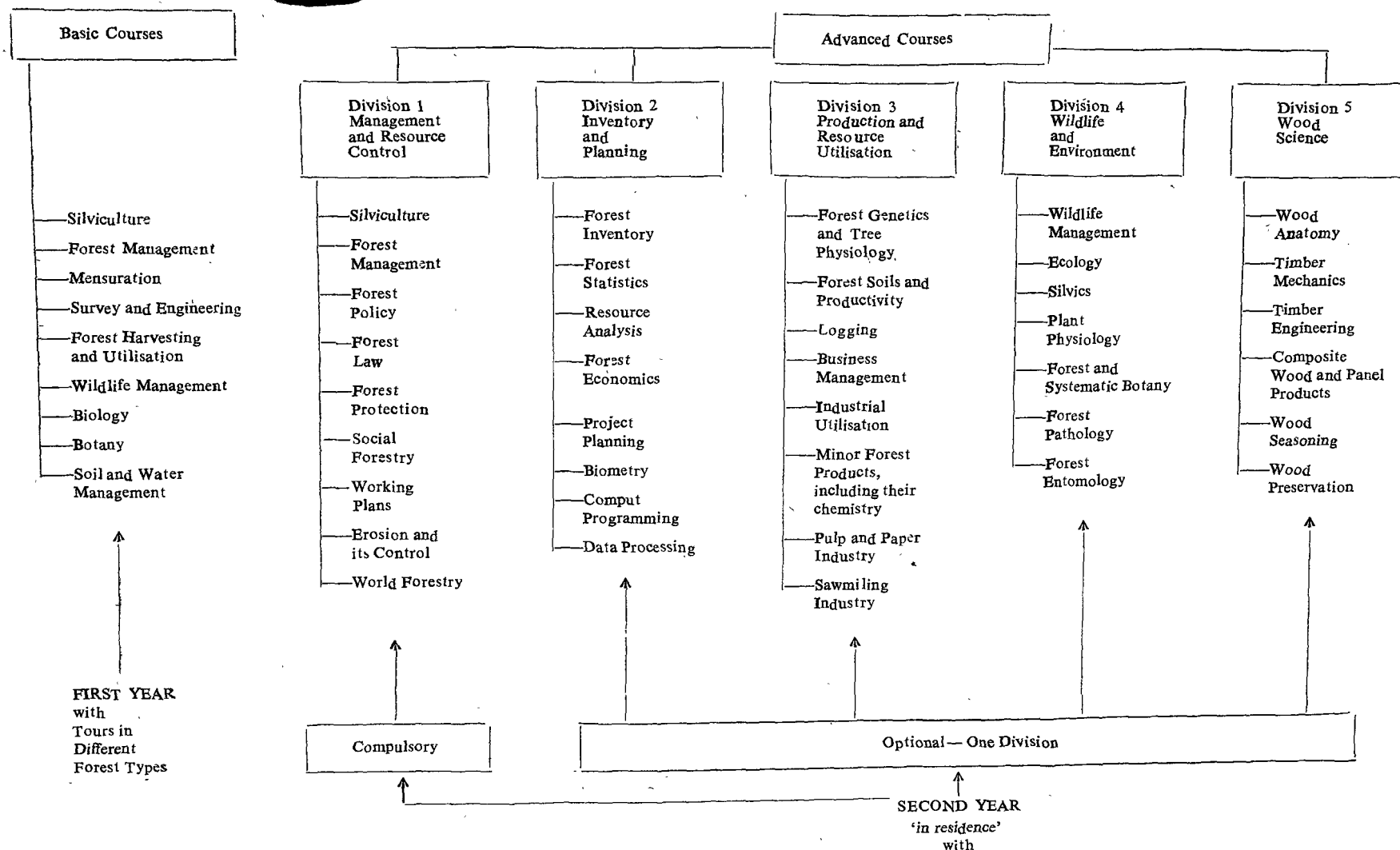
22. An indication of the degree of variability against which the project profitability was tested can be had from the fact that for teak logs, two prices, namely Rs. 450 and Rs. 550 per $m^3(r)$, were used. For costs, percentage increases for which the profitability was tested were 20 per cent and 30 per cent. Using normal prices and costs, a cash flow statement was prepared, indicating the repayment schedule.

23. The plan is part of a comprehensive area development plan of Bastar region, wherein applied research and training programmes have been discussed. Operational plans prescribe specific applied researches, and its cost is included in the benefit-cost stream.

APPENDIX 46.7

(Paragraph 46.7 48)

Organisation of Instruction for In-Service Education and Training for the officers
of the Indian Forest Service and the State Forest Services



NOTE : Subject-wise divisions are illustrative only.

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